INSIDE: MONTANA'S CUTEST SNAKE

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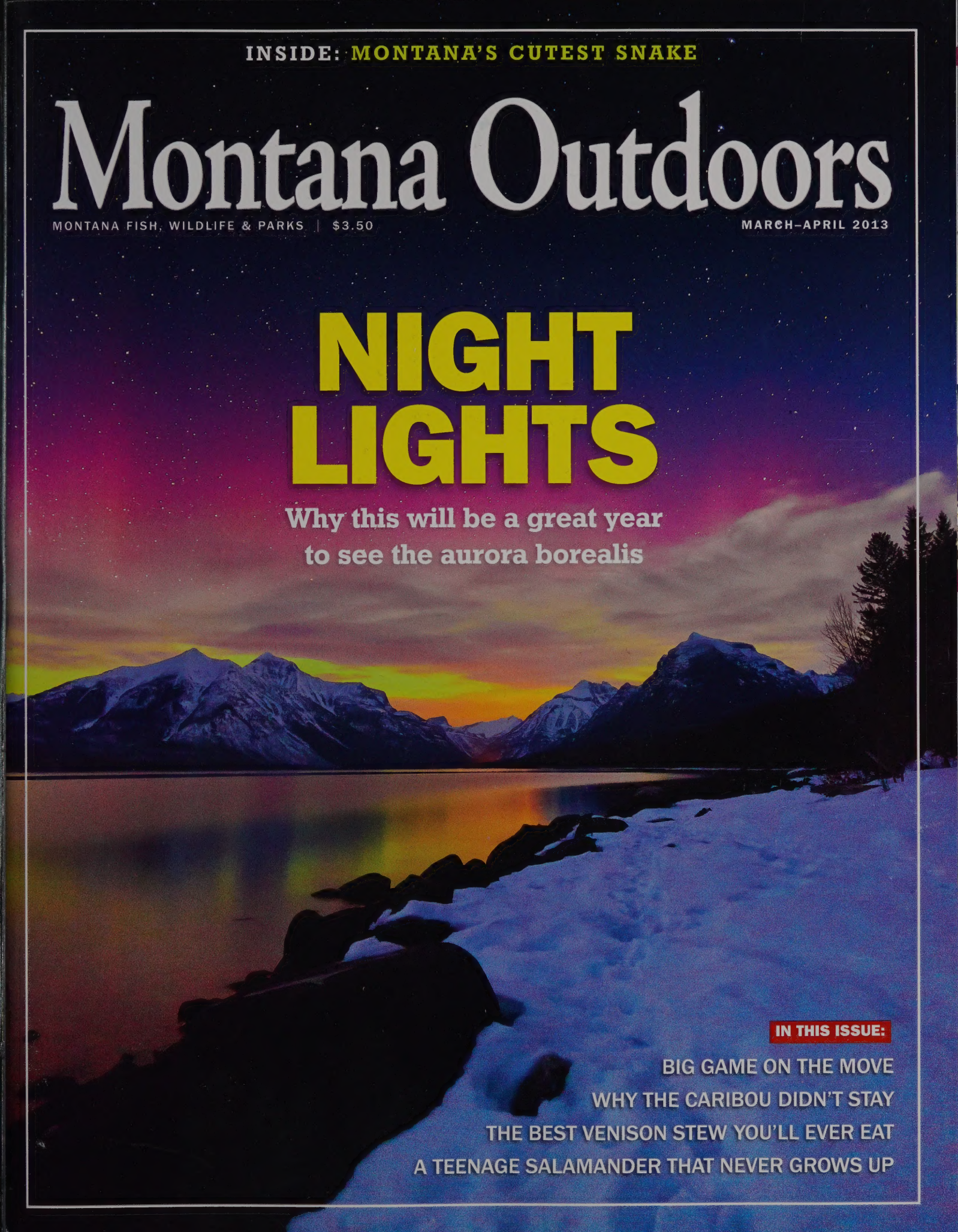
MARCH–APRIL 2013



NIGHT LIGHTS

Why this will be a great year to see the aurora borealis

IN THIS ISSUE:

BIG GAME ON THE MOVE

WHY THE CARIBOU DIDN'T STAY

THE BEST VENISON STEW YOU'LL EVER EAT

A TEENAGE SALAMANDER THAT NEVER GROWS UP

Montana Fish, Wildlife & Parks

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COZY CONDITIONS
In northwestern Montana, whitetails often travel to dense conifer forests to escape deep snow and cold temperatures. Find out about other big game migrations starting on page 20. Photo by Donald M. Jones.

FRONT COVER
Steve Mitchell shot these northern lights over Lake McDonald in Glacier National Park. See more auroras starting on page 28.

Montana Outdoors

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How did he do that?

Despite its humble subject matter, Alex Badyaev's photograph of the deer mouse on the puffball in the January-February 2013 photo issue is extraordinary. Please tell the story of how he captured that remarkable image.

Tim Wylder
Great Falls

Many readers wrote and e-mailed asking how that image was taken and where they may obtain a print (order at tenbestphotos.com). As for photographing the deer mouse, Badyaev explains: "That giant puffball emerged last summer in the Blackfoot Valley next to a trail I walked along each day. Every time I passed the growing mushroom, I noticed it was becoming a social center of local rodents. It seemed that every mouse, chipmunk, and squirrel in the neighborhood would run across the puffball along its route. The bright white top of the mushroom eventually became blackened with hundreds of tiny paw prints. I had an idea of photographing this scene during moonrise; the full moon of July was just a couple of days away.

"I took this photo at around 10 o'clock one evening with a telephoto lens, while lying in the grass about 15 yards away. That flattened the perspective of the moon rising over the vast valley below and made the mouse larger in the frame.

Having the mouse rise up on its hind legs was an unanticipated bonus. It turns out deer mice are exceptionally acrobatic. This one constantly jumped, flipped, and stopped to stand up as it ran back and forth across the mushroom's surface. And it took plenty of pauses atop the puffball, standing up to sniff the air (and, apparently, take in the gorgeous Montana night scene).

"The frontal light on the mouse is mostly from the moon, photographed with an exposure of a few seconds. My bigger challenge was to make the mushroom's surface discernible when photographing it against the moonlight. I did this by mounting a weak remote flash high on a tree over the scene and pointing it straight down. It's the same way a lighting engineer tracks performers on a dark theater stage. Some of the weak 'stage light' from above spilled over to illuminate the front of the mouse, but not enough to prevent it from appearing silhouetted by the full moon."

Still a great deal

I have visited Montana over the past years in all seasons to hike, fish, camp, hunt, and just enjoy the state. While back home, I delight in *Montana Outdoors*. Your magazine reminds of the smell of grasslands, the feel of rough granite boulders and Fort Peck Lake's wind, and the sight of your state's extraordinary wildlife. Each issue is like a visit to Big Sky Country—and an actual visit costs a lot more than the $12 a year you are now charging for a one-year subscription. I would like to thank you for keeping your exceptional magazine so affordable. I will not blink an eye when I renew my subscription, and I don't know why anyone would.

David Emmert
Amherst, VA

Your magazine reminds of the smells of the grasslands, the feel of rough granite boulders.

Necessary removal

Please thank Scott McMillion for a great article concerning the tragedy of the grizzly bear killing ("Terror at Soda Butte," September-October 2012). And thanks for having the guts to explain why the attacking bear had to be killed under the circumstances and why criticisms of the late Mr. Kammer were completely unfounded.

John I. Kittel
Farmington Hills, MI

Step in the right direction

I was pleased to read "Please Do Disturb" in the November-December 2012 issue. This article, in your magazine, is a major step toward public acceptance of good forest management. I have been in the fire ecology and fuels management business for over 50 years and have written a book, *The Sleeping Giant Awakens*, that describes the ups and downs of fire and fuels management since I started in this business in 1959. I am still an active consultant on the subject. My wife Beverly and I co-wrote an article published in your September-October 1981 issue titled "Prescribed Fires: R_x for Wilderness and Wildlife" that spoke primarily to the benefits of fire in wilderness ecosystems. Over the decades, scientists and forest managers have learned a lot about forest management that is based on sound ecological science. Your article will go a long way toward helping folks understand those principles.

Everett M. "Sonny" Stiger
Helena

When the painting belonged to the Montana Club

In last year's March-April issue you ran an article on Montana's art legacy, titled "Visions of What Once Was and May Be Again," that I enjoyed very much. In the story, the author mentions the painting *When the Land Belonged to God*, by Charles M. Russell. Your readers might be interested to know that this work was commissioned in 1913 by the Montana Club, a private club in Helena. As I remember, the price was $6,000, a rather large sum at that time. I was fortunate to have been president of the club when the decision was made to sell the painting to the Montana Historical Society. A statewide fundraising campaign managed to raise the necessary funds to keep the painting in Montana. This was accomplished in the late 1970s, and we are all grateful that this turned out so well.

George Beall
Helena

Write to us

We welcome all your comments, questions, and letters to the editor. We'll edit letters as needed for accuracy, style, and length. Reach us at Montana Outdoors, *P.O. Box 200701, Helena, MT 59620-0701. Or e-mail us at tdickson@mt.gov.*

Tom Reichner

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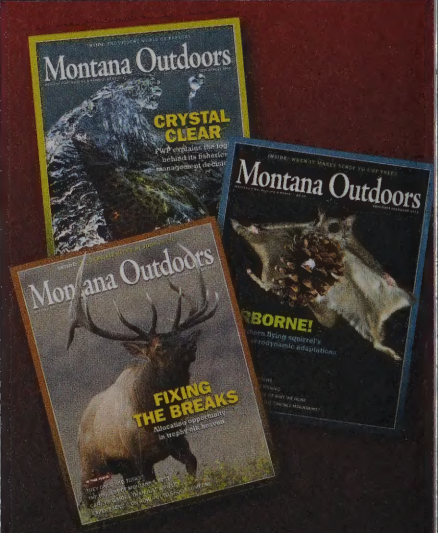

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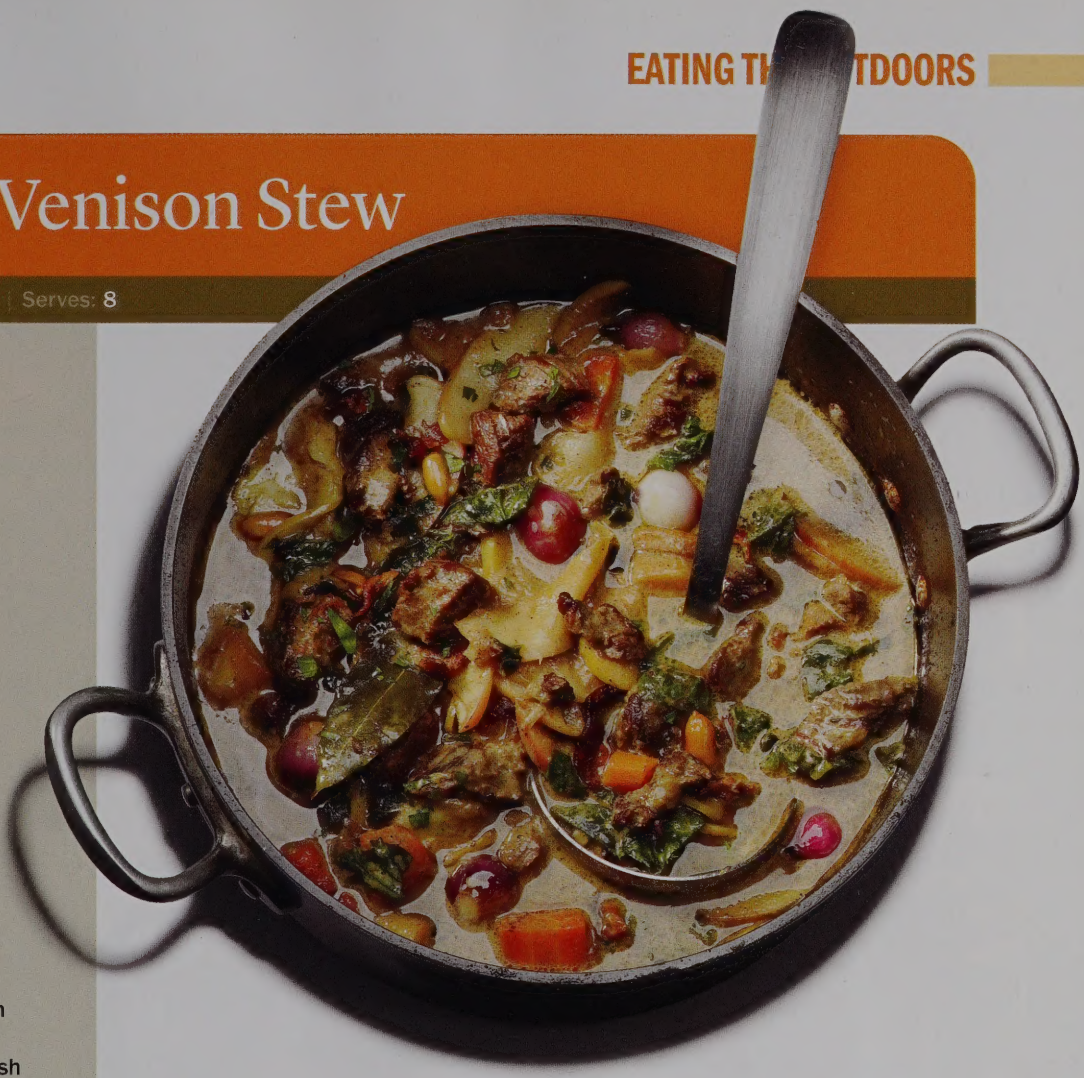
World's Best Venison Stew

By Tom Dickson | Cook Time: 90 min. | Serves: 8



INGREDIENTS

- 3 lb. venison stew meat (or other venison[1]), cut into 1-inch cubes
- 3 T. vegetable oil
- 1 onion, sliced
- 1 T. curry powder, divided
- 2 bay leaves
- 2 juniper berries[2]
- 5 c. water
- 2 c. chicken stock
- 1 c. cream
- ½ c. cider vinegar
- 1 c. ruby port or red wine[3]
- 1 carrot, cut into ½-inch pieces
- 1 parsnip, cut into ½-inch pieces
- 1 c. frozen pearl onions
- 2 T. cream cheese
- 6 bacon slices, finely diced
- 2 T. roughly chopped peanuts
- 1 T. honey
- 2 Granny Smith apples, cored and cut into ⅛-inch slices
- 1 c. shredded spinach, fresh or frozen
- Mashed or boiled new potatoes
- 1 T. grated fresh or bottled horseradish
- 1 T. coarsely chopped parsley

PREPARATION

Heat oil in a Dutch oven or large stew pot. Season venison with salt and pepper. Sauté meat, onion, and ½ T. curry powder 8 minutes. Add bay leaves, juniper berries, and 4 c. water. Bring to a simmer and cook for 40 minutes.

Pour in stock, cream, vinegar, port or wine, and 1 c. water. Simmer 20 minutes. Add carrot, parsnip, and pearl onions and simmer 20 minutes more. Stir in cream cheese.

While stew is cooking, heat a large fry pan over low heat and cook bacon until crispy, about 10 minutes. Drain grease, leaving 2 T. in pan. Add peanuts and remaining ½ T. curry powder and sauté 2 minutes. Add honey and apples and stir to coat. Add spinach and cook 2 minutes. Stir mixture into stew just before serving over potatoes, garnishing with horseradish and parsley. ■

[1] If you use standard venison roast or steak meat from the upper hindquarters, reduce total cooking time by about half to prevent the meat from drying out.

[2] Pick ripe (purple) berries off juniper bushes found in most Montana neighborhoods. Or substitute 1 t. gin.

[3] Australian Shiraz or California Merlot or Cabernet.

LEVI BROWN

This recipe has an international pedigree, but its luscious mix of down-home flavors will be familiar to any Montana family at dinner time.

The dish comes from Marcus Samuelsson, a chef and restauranteur who now lives in New York City. Samuelsson was born in Ethiopia but grew up in Sweden, where moose and deer are mainstays. His worldly background influenced this stew recipe, which incorporates a wide range of sweet, tart, and savory flavors.

The recipe first appeared last year in *Field & Stream*. Since then I've made it half a dozen times, always to rave reviews. The stew's wonderful flavor comes from the many diverse, though common, ingredients. (The version here omits or substitutes for a few ingredients in the original recipe that I found hard to locate or unnecessarily fussy.)

As with any stew, try to use meat from the shoulder. Generally too tough to roast because it's laced with connective tissue, shoulder meat is ideal for stewing or braising. These common cooking methods use low temperature, moist heat, and longer cooking time to transform tough tissue into a savory goo that infuses the juicy, fork-tender meat with flavor.

Second best for stews are cut-up bottom round roasts, from the lower part of the hindquarters just above the shanks. Try not to use loin or sirloin for stews or braising, because the meat, lacking collagen, can dry out (even though it's cooked in liquid).

If you don't know what part of the animal your frozen venison packets came from, look the meat over once it's thawed. Lots of internal tissue means shoulder meat. Clean red meat with little white inside is probably from the upper hindquarters and would be best roasted or grilled. If you must use loin, sirloin, or other tender cuts for this recipe, cut the cooking time in half.

—Tom Dickson is the editor of Montana Outdoors.

Respecting other perspectives

I was both honored and encouraged earlier this year when Governor Steve Bullock appointed me director of Montana Fish, Wildlife & Parks.

It was an honor knowing I'd be back at the helm of this remarkable agency. FWP plays an essential role in Montana's outdoor culture and recreation-based economy. And it's staffed by a dedicated and professional corps of biologists, game wardens, park managers, and others. I know of no more committed, qualified, and experienced group of conservation professionals than the men and women working for this department.

FWP

Encouragement came from across the state. Over the past two months I've heard from conservationists, legislators, guides and outfitters, livestock operators, and others—Democrats and Republicans—who told me they agreed with Governor Bullock's sensible approach to state management that looks for common ground and consensus.

That's the same approach I use for managing Montana's fish and wildlife conservation agency. My goal is to find solutions to fish and wildlife management issues. That almost always requires a lot of building—building relationships, building trust, and building on Montana's best traditions of wildlife conservation. And it means maintaining and strengthening good relations between landowners and sportsmen.

Disagreements about fish and wildlife management are nothing new. That's good; it shows that people care. In fact, the worst thing for bison, elk, wolves, walleyes, trout, and state parks would be if no one walked up to the microphone at an FWP Commission hearing or voiced an opinion in public input meetings.

But just because people disagree doesn't mean they can't respect each other's opinions and values.

As was the case when I was the FWP director from 2001 to 2008, my door is always open. If you have a beef with department policies or actions, come on in and let's talk. I can't say I'll do whatever you ask—that would be a reckless promise—but I will listen carefully and respectfully and do my best to understand your point of view and those of other individuals you may represent.

Ultimately, my responsibility and that of FWP is to the fish and wildlife resources of Montana. The legislature created this department to establish a cadre of trained professionals dedicated to fish and wildlife stewardship for today's citizens and visitors and those of future generations. That's our mission, and we won't ever lose sight of that.

But the road to effective fish and wildlife conservation can take many routes. I'm a firm believer in the idea that if everyone compromises a little, we can all find common ground that strengthens Montana's great tradition of sustaining abundant and diverse fish and wildlife. I also believe we can find ways for those natural resources to continue supporting top-notch hunting, fishing, and wildlife watching in a manner that recognizes the rights of the public to wildlife held in trust by the state as well as the rights of private property owners.

> "Just because people disagree doesn't mean they can't respect each other's opinions and values.

If there's one word to represent what I and this department have in store for the next four years, it's "respect." FWP will continue to respect the fish and wildlife we're entrusted to conserve, while at the same time respecting hunters, anglers, landowners, outfitters, nonhunters, local businesses, wildlife watchers, and others whose values, livelihoods, or recreational activities are affected by how we manage those resources.

That's how things worked when I was here in the past, and that's how things will work from now on.

M. Jeff Hagener

—**M. JEFF HAGENER,** *Montana FWP Director*

THOMAS LEE

THE FRONT LINE

SHIRLEY SWECKER
Front Office Manager, FWP Region 3 Headquarters, Bozeman

One thing about working the front office: There's never a dull moment. The other staff and I are constantly answering questions that come in by phone, by e-mail, and from people visiting the headquarters. We provide answers about fishing, hunting, trapping, wildlife viewing, licensing, permits, state parks, regulations, residency requirements, wounded animals, game damage, private ponds—you name it.

We have to be human encyclopedias, familiar with every rule and regulation you can imagine, from youth hunting opportunities to the latest mountain lion quotas to explaining the difference between a cutthroat trout and a rainbow trout. Sometimes we have to be very patient and diplomatic, like the time an out-of-state visitor came in to the office and, after looking at the mounts on the wall, asked me how long it takes for a deer to turn into an elk.

Because we need to know pretty much everything that goes on in FWP, all of us in the front office get out and visit state parks, wildlife management areas, and fishing access sites whenever we can. We also interact with biologists, technicians, park managers, and other FWP employees to learn what's happening in their field jobs.

In addition to providing information to the public and managing our seven highly skilled front office staff, I do administrative work such as typing, budgeting, and scheduling meetings.

Working the front office is exciting and often challenging. We do get some angry calls, especially over bison or wolves. But for the most part our customers are wonderful and just want to know more about FWP and what goes on here. People are passionate about their fish and wildlife, and that's great. I love my job and am proud to represent this agency to the many people who call or stop by.

Washington state photographer **KEN ARCHER** operates a newspaper press as his day job, but his passion is shooting wildlife images. "If I could do that full time, I would," he says. Archer travels to Montana several times each year in search of wildlife, like this red fox he photographed in the Gallatin National Forest. "My wife and I spotted it from the car and got out to take some shots. The fox was moving east, hunting, and I could see it was heading to a creek bed along a mountainside, about 300 yards away, that had some nice snowdrifts next to it." Archer jogged along the road to get ahead of the fox, then sat down in 3 feet of new snow to wait. "He disappeared over a ridge and I was sure I'd lost him, but then after a few minutes he appeared out of nowhere and started coming right toward me. That's when I got this shot." ■

50

Montana's daily limit, in pounds, for bull trout in 1913, part of misguided efforts to eradicate what was then considered a "destructive" species.

"New" March 15 deadline nears

Hunters long accustomed to applying for deer and elk permits in late spring need to remember the deadline is now March 15.

This is the second year of the earlier deadline. The FWP Commission moved it ahead to give successful permit applicants three additional months to plan their fall hunts.

Other application deadlines remain the same as in years past: June 1 for antlerless deer (Deer B), antlerless elk (Elk B), and all antelope licenses. May 1 is still the application deadline for moose, bison, bighorn sheep, and mountain goats. Questions? Call FWP at (406) 444-2950.

WILDLIFE MOVEMENT

SD cougar shot near Monarch

The Black Hills cougar

In late January, a local hunter killed a female mountain lion in the Little Belt Mountains near Monarch, southeast of Great Falls, that had emigrated from South Dakota's Black Hills.

Cory Loecker, FWP area biologist, says the cougar was well known in the area because it wore a numbered yellow ear tag and a radio collar. He learned the lion had been incidentally caught in late 2007 by a bobcat trapper in the Black Hills National Forest west of Rapid City. A biologist with South Dakota Game, Fish & Parks collared the captured lion, estimated to be one and a half years old at the time. It was last seen in the Black Hills that following spring.

Between then and December 2008, the lion traveled west and ended up in Montana's Little Belt Mountains. "Her range seemed to be in and around Sluice Boxes State Park," Loecker says.

Upon examination, the six-and-a-half-year-old lion was not lactating, indicating it did not have kittens.

Though young male cougars sometimes roam for hundreds of miles to find new territories, it's rare for a female to travel that far. "Between here and the Black Hills is nearly 500 miles, as the crow flies," says Loecker. "You have to wonder why she didn't find the right habitat niche sooner, and what it was about this area that made her want to stay here and not keep going. It just goes to show that wildlife species have no boundaries here in the wild West." ■

COOPERATION

Hunters chip in to restore burned fencing

It's hard to imagine any good coming out of the destruction caused by last summer's Ash Creek fire. The conflagration was ignited by lightning during a hot spell in late June. Winds that gusted up to 50 mph whipped the blaze into a firestorm that eventually consumed 250,000 acres surrounding the town of Ashland. Dozens of homes, outbuildings, and stock tanks were damaged or destroyed.

"My great-grandparents' homestead, built in the 1880s and still being lived in, was burned to the ground, along with the barn and corral," says Clint McRae, owner of the Rocker Six Cattle Company in Forsyth.

When smoke finally cleared several days later, McRae assessed even more damage. "We lost 60 percent of our summer grass, 8,000 acres, and 26 miles of fence. And we were the luckier ones," he says.

One bright spot in the tragedy was the outpouring of goodwill it inspired among neighbors, townspeople, hunters, and others. The Montana Game Wardens Association and nine sportsmen and conservation groups raised more than $11,000 to buy fencing materials for McRae and seven other landowners enrolled in Montana's Block Management Program.

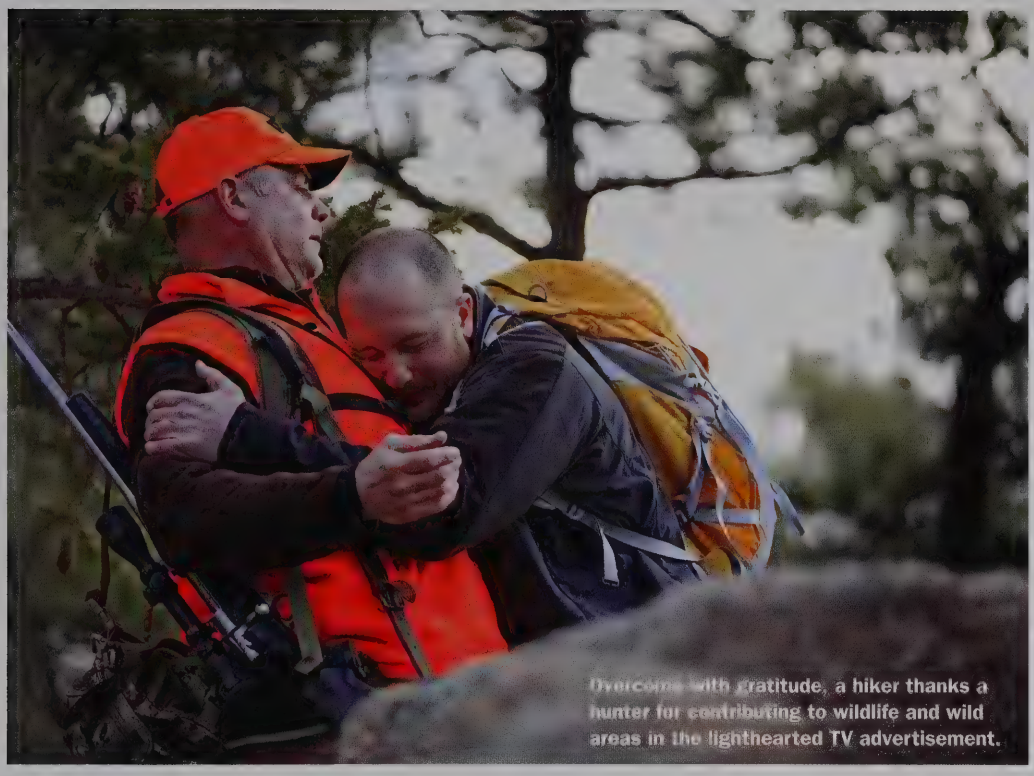
"We wanted to help offset at least some of their out-of-pocket expenses," says Bill Dawson, the FWP game warden in Ashland.

The 2012 Ash Creek fire near Ashland

Donations for the new fencing came in from hunting groups as far away as Ravalli County in western Montana.

"When hunters feel compelled not only to donate their labor but also buy and donate material, it gives us pause to realize people appreciate the public access we provide," says McRae. ■

CLOCKWISE FROM TOP LEFT: ILLUSTRATION BY MIKE MORAN; KEVIN JACKSON; HUGAHUNTER.COM; MONTANA NATURAL HERITAGE PROGRAM; KTVQ; MONTANA FWP



Overcome with gratitude, a hiker thanks a hunter for contributing to wildlife and wild areas in the lighthearted TV advertisement.

COMMUNICATION

Ad campaign promotes hunter hugging

Imagine you did something important for society, but no one knew about it.

That's how America's hunters feel.

With their license fees and federal excise tax payments, hunters have contributed hundreds of millions of dollars to restore wildlife populations and protect habitat. The benefits have been enormous: vast herds of elk, deer, and pronghorn; wildlife areas open to public hunting, hiking, and birding; and protected wetlands that filter sediment and pollutants from water.

But other than hunters themselves, who knew they were doing so much for the common good?

The residents of Colorado sure do. This past year the state's Wildlife Council launched a humorous advertising campaign meant to open the eyes of nonhunters to the contributions that men and women in camo and blaze orange make to Colorado's outdoors. Comprising representatives of businesses, conservation groups, and other interests across the state, the council is charged with publicizing hunting and fishing management and activities.

The ads begin by noting that all Coloradans are proud of their state's wildlife and natural beauty, and they have hunters (and anglers) to thank for their contributions, adding, "so if you love protecting Colorado and its natural beauty, go ahead and hug a hunter."

In the TV spot, a gracious hiker walks up to a hunter and wraps him in a big embrace. A similar promotion shows a mountain biker hugging a fly-fisherman in gratitude for the angler's contribution to making rivers healthier.

Windi Padia, Education Section manager with Colorado Parks and Wildlife, says the lighthearted campaign has been a big hit. "I've had a lot of positive comments from the public, and only one criticism—from a hunter being teased by his friends about the hugging."

Padia says follow-up surveys verify the campaign's success. "People remember the ads and understand the point being made," she says. "We know it has increased support for hunters and anglers in this state, which was a major goal."

FWP and other western conservation agencies are looking at the campaign to see if it might work as well in other states. ■

See the Hug a Hunter and Hug an Angler television advertisements at hugahunter.com (click on "About the Wildlife Council" and then "Advertising").

All in one spot

Do alligator snapping turtles swim in the lower Yellowstone River?

Where is the state's densest concentration of prairie potholes?

Which parts of Montana hold the most Canada lynx?

The answers, courtesy of the Montana Field Guide, are: yes; north-central and northeastern Montana; and the areas in red on the map below.

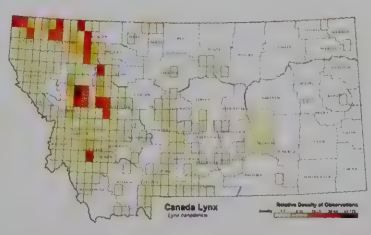
Few questions about Montana's outdoor life cannot be answered by the Montana Field Guide, a website and database jointly produced and maintained by FWP and the Montana Natural Heritage Program. The guide provides up-to-date biological information on more than 1,000 mammals, birds, amphibians, insects, reptiles, and other animals, as well as plants (including noxious weeds), lichens, and ecological systems.

For most animals, the guide includes photographs, a general description, and a map indicating summer and winter distribution in Montana and North America. It also shows each species' relative population density across Montana and, if applicable, its global, national, and state status as an endangered, threatened, or "of concern" species.

The guide includes links to other websites that provide additional photos and information for each species. Another link takes you to a site showing where other people have seen each species and lets you report your observations.

A new feature offers an off-line version of the guide you can download to your tablet or smart phone for camping or hiking when you want to identify plants and animals but Internet access is limited.

Visit fieldguide.mt.gov. ■



Relative density of Canada lynx in Montana, based on 1,903 sightings. (From the Montana Field Guide website.)

Much Too Short a Visit

Several woodland caribou that entered northwestern Montana from Canada last spring met a grim fate. Will future incursions by these native-but-now-absent big game animals last longer? **BY DANIEL PERSON**

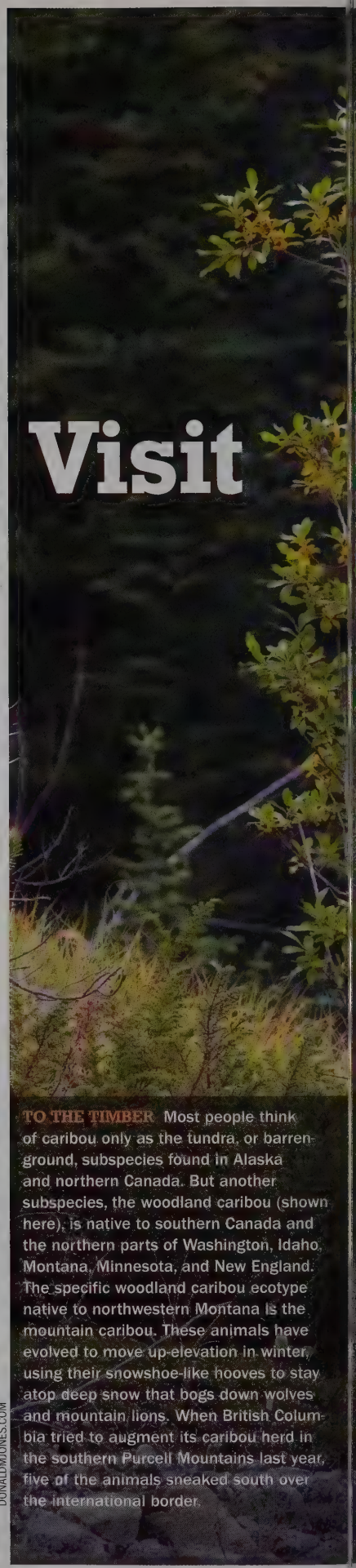
In early March 2012, biologists drove cattle trucks into the Purcell Mountains in southern British Columbia, then backed into a makeshift corral to allow the cargo to stretch their knobby, bell-bottomed legs.

The woodland caribou had begun as a group of 20, captured in northern British Columbia and transported south to within 40 miles of the Montana border. One animal died en route, and after being let off the truck, the 19 that remained were tranquilized and loaded onto helicopters that, like whirling Noah's arks, whisked the animals, two at a time, to higher ground and deeper snowpacks.

In winter, woodland caribou need two things more than all else: deep snow and arboreal (tree) lichen. The snow keeps predators at bay. The lichen, named old man's beard for the way it hangs from the moist subalpine fir and Engelmann spruce trees of the Inland Northwest, is for eating.

The Purcells, which dip into Montana, have historically contained both, providing habitat for a healthy, if not large, population of woodland caribou.

But during the 1990s, the number of animals there dropped drastically. By the early 2000s, biologists in British Columbia began to fear that, without new stock to increase genetic diversity and boost herd size, woodland caribou would cease to exist in the southern Purcells. ▸▸



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TO THE TIMBER Most people think of caribou only as the tundra, or barren-ground, subspecies found in Alaska and northern Canada. But another subspecies, the woodland caribou (shown here), is native to southern Canada and the northern parts of Washington, Idaho, Montana, Minnesota, and New England. The specific woodland caribou ecotype native to northwestern Montana is the mountain caribou. These animals have evolved to move up-elevation in winter, using their snowshoe-like hooves to stay atop deep snow that bogs down wolves and mountain lions. When British Columbia tried to augment its caribou herd in the southern Purcell Mountains last year, five of the animals sneaked south over the international border.

That's an outcome Montana biologists know well. The animals, a subspecies related to the caribou that migrate across the Alaskan arctic plains and the reindeer of northern Scandinavia and Russia, were once found as far south in North America as Lolo Pass in the Bitterroot Mountains. But by the mid-1980s, when the woodland caribou in Montana came up for consideration for endangered species protection, it appeared that not a single one remained to be protected.

Today, two generations removed from the last known resident herd, caribou are an animal that Montanans never knew they lost.

The disappearance of caribou is especially notable given the recovery of other species in Montana once on the brink of disappearance: grizzlies, wolves, and bald eagles. "The woodland caribou is the only historically native big game species that we're still missing," says Jim Williams, regional wildlife manager in Kalispell for Montana Fish, Wildlife & Parks.

Montana's experience with caribou is one the Canadian government does not want to see play out in the southern Purcell Mountains. And so came the trucks and the 19 caribou to join 14 already living there.

Off the helicopters and out from under sedation, the caribou ambled away, trudging through fresh powder into a stand of trees. Video of the release shows snow matted onto the caribou's coats, making them look like the ghosts they have become across much of their American range.

But something interesting, if not totally unexpected, occurred after the caribou's release. Five of the transplants made a quiet pass across the wooded international border into Montana. For most of the animals, the visit was tragic: Three were killed by predators, while another almost perished from tick paralysis. Only one, a bull, returned to Canada unscathed.

WRONG WAY Last year Canadian biologists hoped the 19 caribou they released in the southern Purcells just north of the Montana border would follow local caribou to higher elevations, where fewer predators lived. Instead, many took off downhill and perished.

The five animals' cross-border journey told British Columbia biologists that they needed to find ways to keep future transplanted caribou from moving south, where more predators live. But for Montana biologists, the reappearance of caribou—if only for a few short weeks—was a tantalizing glimpse into the possibility of restoring a big game species that once called at least a small part of the state home. As biologists plan to transport another batch next winter (see sidebar, page 14), all eyes will be watching to see whether, in trying to avoid Montana's fate with caribou, the Canadians will in fact reverse it.

LOST IN OLD-GROWTH

No one knows how many caribou roamed the mountains of far-western Montana before European settlement. But an exhaustive report by FWP biologist Tim Manley in 1986 definitively shows that the population consisted of more than the occasional straggler from the north.

For Tobacco Plains Indians like the Kootenais, oral tradition suggests they regularly hunted caribou in the Yaak drainage. There are also the place names—such as Caribou Mountain in the southern Purcells and Caribou Creek near Libby. The Kootenai name for Logan Pass in Glacier National Park—"Bigfeet was Killed"—likely refers to the woodland caribou's huge hooves. (In the 1920s, members of the Kai'na Band of the Niitsitpi reportedly killed a bull caribou near the pass.)

During ensuing decades, reports of caribou came in fits and starts. A herd of between 8 and 12 was seen near Lolo Pass in the 1930s, and a herd of 35 was reported in the Yaak drainage in the 1940s. The most documented sightings of caribou in Montana came in the 1950s, unfortunately for reasons heralding the animal's coming demise.

The caribou's ornate antlers are what first draw the eye. But just as the Kootenai reference to "Bigfeet" suggests, nothing speaks to the caribou's identity more than its enormous hooves. Shaped like bisected dinner plates, the hooves use the same physics as snowshoes to keep caribou atop deep snow. When winter comes and most animals—including predators—head to lower elevations for easier mobility, caribou move uphill, where they browse on hanging arboreal lichen accessible only when the animals are standing on deep snowpack.

"These caribou have carved out a niche that no other ungulates have learned," says Joe Scott, director of Conservation Northwest, a nonprofit group monitoring efforts to bolster the southern Purcell herd. "They lose themselves in old-growth forests."

Which gets to why the 1950s were so devastating to Montana caribou. In the 1940s, severe winds flattened high-elevation spruce-fir stands across the state's northwestern region, followed by a spruce bark beetle epidemic. A decade later, in an effort to salvage the blown-down and insect-

BRANCH BROWSE Also known as old man's beard, horsehair lichen is a type of arboreal lichen favored by mountain caribou. By standing on deep snow in winter, the animals can feed off higher branches that are inaccessible at other times of year. Mountain caribou also eat the wispy strands of lichen when branches break off old-growth trees and fall to the ground.

LICHEN PHOTO BY JASON HOLLINGER; MAP: *MONTANA OUTDOORS*

Previously a journalist in Bozeman, Daniel Person now works in Seattle. A version of this article originally appeared in the summer 2012 issue of Montana Quarterly.

LONG, STRANGE TRIP In March 2012, British Columbia biologists trapped caribou from a large herd in the province's northern region. The animals were sedated and fitted with GPS satellite transmitters (top left) so their movements could be tracked. FWP biologists Tim Thier and Jim Williams (top right) were invited by their Canadian colleagues to help handle the large animals. The caribou were trucked south then helicoptered (above left) to release sites in the southern Purcells. Above right: Instead of sniffing the tracks of local caribou and following them to safe sites, as biologists had planned, the released animals ran off. "I think they woke up from sedation and said to themselves, 'That was awful; we're getting out of here,'" says Leo DeGroot, a caribou recovery project leader for British Columbia's Ministry of Environment.

CLOCKWISE FROM TOP LEFT: DAVE HEAGY, PROVINCIAL GOVERNMENT OF BRITISH COLUMBIA; FWP; FWP; TARA SZKORUPA, PROVINCIAL GOVERNMENT OF BRITISH COLUMBIA

killed timber for commercial use, logging was greatly expanded in the caribou's highland habitat.

In his 1986 report, Manley suggests that the increased number of loggers in the highlands was in part responsible for the growing number of caribou sightings.

And, like bugs under a rock, the exposed caribou scattered.

Cutting down old-growth forest removed the ancient trees where lichen grow. What's more, logging roads and early-growth trees and shrubs made the high-elevation habitat more hospitable to other ungulates like deer. They, in turn, attracted cougars and wolves, which caribou had once been able to avoid. "That gets to their very survival strategy," says Tim Thier, an FWP wildlife biologist in Eureka, a town just 6 miles from the Canada border. "When you open up the forest canopy at higher elevations, you make it more conducive to deer, moose, and elk, which gives predators incentive to follow."

Forest fire has much the same effect. Large blazes in the early 20th century appear to have wiped out prime old-growth habitat used by caribou. By 1986, after decades of sporadic reports in Montana, biologists could not find a single caribou during four consecutive years of searching. While small populations in the Selkirk Mountains of northern Idaho and northeastern Washington received endangered species protection, Manley concluded in his report that Montana would have to start from scratch. "If caribou are ever to become established within Montana, then it would most likely have to be through re-introductions," he wrote.

PATCHES OF POSSIBILITY

In the 1990s, FWP biologists explored the possibility of relocating caribou to Montana and found suitable forested areas in the Whitefish and Purcell Ranges. "We don't have the habitat for caribou we had in the 1800s, but we still have some patches," Thier says. But the effort to transplant caribou into Montana didn't get far, partly because acquiring the animals is so difficult. "British Columbia barely has enough for its own recovery effort, much less extras for us," says Williams.

Meanwhile, between the time of Manley's report and the transplant of 19 caribou last March, things hadn't gotten much better for the species in the U.S.–Canada border region. A transplant of 103 caribou in the late 1980s and early '90s into the southern Selkirks, meant to augment an Idaho

PLAN B For its scheduled 2014 caribou transplant, British Columbia is taking steps to ensure that the released caribou stay at high elevations, where deep winter snow adds to their safety.

herd of 30, resulted in a net gain of only 18 animals. A mountain lion that biologists dubbed "Mr. Nasty," responsible for killing at least three of the caribou and probably more, is partly blamed for the low survival rate. Then in 2009, an avalanche in Banff National Park wiped out most of the park's herd, raising questions about that population's viability.

Caribou advocates in northern Idaho contend that increased snowmobile and skiing activity harms that state's remaining caribou. They say the winter recreationists cause the animals to expend precious energy while seeking areas with less human activity. In recent years only a few caribou have been counted in northern Idaho. Some local communities, claiming that caribou are now extirpated (locally extinct), are petitioning to have the animal taken off the endangered species list in hopes of lifting logging and snowmobiling restrictions.

And then came the Purcell transplant.

The first of the five caribou that migrated to Montana last spring announced its arrival in particularly grim fashion: a mortality signal from south of Eureka. As originally reported by the *Missoulian*, Thier, Manley, and Williams snowmobiled to the area to recover what they expected would be a carcass. Instead they found an alive but paralyzed caribou. The animal was rushed to a veterinary clinic in Eureka, treated for a tick-borne disease, and then taken back to Canada.

Excitement surrounded the next caribou to cross the border. It was pregnant, leading some news reports to herald the possibility of the first documented caribou birth in Montana in decades. But the birth never occurred. The pregnant cow broke a leg and was killed by a predator, likely a lion. Its radio collar led biologists to three-quarters of the animal's body. "It was just heartbreaking," Thier says. "Here was this cow just days from giving birth."

The third and fourth visiting caribou were killed by wolves. Only the fifth, a bull, managed to make it back to Canada alive.

BC biologist hopeful about 2014

The silver lining to last year's disappointing caribou release was how much Leo DeGroot and other wildlife biologists learned and can apply to their next attempt. "In 2014 we plan to use a different source population," says DeGroot, a mountain caribou recovery project leader for British Columbia's Ministry of Environment. "We'll also pen the released animals with local caribou for a week or so to force them to rub noses, so to speak, and bond."

BC biologist Leo DeGroot

In 2012, biologists used the northern ecotype of woodland caribou captured in the northern part of the province. "Removing 20 didn't make near the dent in that large herd as it would have if we had taken that many from the smaller herds of the mountain ecotype," DeGroot explains. Most northern woodland caribou don't venture to high elevations during winter, preferring to dig through snow to find ground lichen. DeGroot says he hoped the released animals would bond with local mountain caribou at the release site in the southern Purcells and follow them to higher elevations, learning to feed on tree lichen.

Unfortunately, the local caribou were scared off by helicopters landing to unload the first group of transplants. "We thought the new caribou would smell the locals and and follow," DeGroot says. "But instead they came out of sedation and took off, ending up 10 miles away the next day." The same thing happened with the second group. Instinctively, some headed to lower elevations, where they eventually ran into cougars or wolves.

For the next effort, scheduled for March 2014, biologists have two strategies for making sure released caribou stay at the safer higher elevations. One is to use the mountain ecotype rather than the northern ecotype. The other is to plow a road to a high-elevation site and release the caribou from a truck into a 2-acre corral where several resident caribou will be placed beforehand. "After a week or so of letting those caribou get to know each other, we'll open the corral," says DeGroot. "The resident ones should know where to go, and hopefully the transplants will follow."

—Tom Dickson

CLOCKWISE FROM TOP LEFT: FWP; DONALDMJONES.COM; JIM WILLIAMS/FWP

Caribou north of the border hardly fared better. Just 7 of the original 19 lived through August, according to British Columbia biologists. About half of those that died were killed by lions or wolves and the rest perished from accidents or unknown causes. Clearly disappointed Canadian biologists told reporters they will try to make sure the next set of released caribou fare better. For one thing, they said, they'll take efforts to keep the animals from migrating to Montana, where lower elevations mean higher predator densities.

ROADBLOCKS AHEAD

Thier shrugs off the notion that the caribou's hard luck in Montana means the state's mountains are no longer suitable habitat. "Whenever you release animals, it's typical to put them in the best habitat, but they'll go here, they'll go there, they'll go to places that aren't too good," he says. "The areas where they ended up weren't good habitats." He explains that predation of the released caribou came in low-elevation areas of Montana and British Columbia, outside of what biologists consider suitable habitat.

That's not to say Thier disagrees with the Canadian biologists' plan to prevent the immediate southward journeys seen last spring. He envisions a slower and more sustainable recovery of the animals. "It's our hope that this population builds and, as it builds, that caribou move into some appropriate habitat in Montana," he says. "To a huge degree, this is a last best effort. [The Canadian biologists] are putting all they can into it. If it doesn't succeed in Canada, we'll need to figure out why it didn't work there," before even considering transplant efforts in Montana.

Others, like Scott, are not as optimistic for Montana. One of the major challenges in caribou recovery is their slow reproduction rate. Even under the best-case scenario, he says, a decade of herd growth wouldn't be enough to spill into Montana. The addition of climate change and the loss of old-growth forests may create a more permanent setback to the animals, not just in Montana, but across the Inland Northwest.

"They're amazingly adaptable. But we've put some significant roadblocks in their way," Scott says. "We have some work to do if we want to keep them around."

FINGERS CROSSED Montana biologists are closely monitoring the movements of caribou released north of the border. "We're helping any way we can," says Jim Williams, FWP regional wildlife manager in Kalispell. "But it's really up to the caribou themselves. If the population there gets large enough so that some start making their way across the border, that would be great. On the other hand, if they can't survive in British Columbia, the likelihood that they'll survive here in Montana is very slim."

Transform

The bizarre life history of Montana's barred tiger salamanders

BY PAUL J. DRISCOLL

At first glance, there's nothing remarkable about the Axolotl Lakes, ten small lakes and potholes that sit among subalpine meadows and dry, timbered slopes in southwestern Montana roughly 15 miles southeast of Ennis. It's a scenic area, to be sure, but nothing out of the ordinary in a state filled with beautiful landscapes.

Yet beneath the water surface of two lakes in the basin lives what may be the strangest creature in Montana. It's the axolotl, (*ack-suh-LOT-uhl*), a unique and biologically baffling form of the barred tiger salamander.

Barred tiger salamanders are, for the most part, ordinary amphibians. They live throughout the central United States, central Canada, and northern Mexico. In Montana they are found across the central and eastern parts of the state as well as in the Tobacco Valley near Eureka. ▸▸

JOHN P. CLARE/CAUDATA.ORG

ers

ARRESTED DEVELOPMENT Shown here is the larval form of the barred tiger salamander. Some individuals remain like this throughout their life while also developing sexual organs. These sexually mature "teenage" salamanders are known as axolotls. The similar looking true axolotl is a different salamander species native to central Mexico.

Salamanders such as the barred tiger species, as well as frogs and toads, are in the taxonomic class amphibia, which means "double life" in Greek (*amphi* for "two" and *bio* for "life"). Their first life stage occurs in water, usually as larvae that hatch from eggs. Like the tadpoles of frogs, salamander larvae then metamorphose, or alter form, into adults, which crawl up onto land to live out their lives.

It's an ancient story stretching back hundreds of millions of years. Amphibians were among the earliest life forms to evolve from water creatures into terrestrial ones.

Over time, barred tiger salamander populations adapted to their unique environments in North America. For instance, those in the central Great Plains evolved to spawn in buffalo wallows and prairie potholes that temporarily filled with snowmelt in spring. Populations in the Rocky Mountain West evolved to spawn in high-elevation fishless ponds and lakes, such as those in the Axolotl Lakes Basin.

The larval phase of salamanders differs slightly from that of frogs and toads. The oxygen-filtering gills are external and look like fine feathers extending behind the head. Also, a salamander larva has tiny legs and feet at hatching, unlike limbless frog and toad tadpoles. Like those of frogs and toads, salamander larvae resemble small fish as they slice through their natal pool powered by a single caudal (tail) fin.

"After a few months, stress causes a release of hormones that trigger metamorphosis," says Bryce Maxell, co-author of *Amphibians and Reptiles of Montana* and a senior zoologist with the Montana Natural Heritage Program. "Usually the stress comes from lack of food, or lots of predators, or crowded conditions as the pool where the larvae live dries up. The salamanders develop lungs and other adaptations in order to move to terrestrial habitats and away from these stressors."

In some pothole breeding pools that quickly shrink in the hot summer sun, Maxell adds, the larvae resort to cannibalism to rapidly gain size and weight so they will metamorphose more quickly.

As a larva transforms its shape, the salamander's trademark long tail begins to grow, and the legs and feet grow bigger. Internal lungs develop, external gills shrink and are absorbed into the head, and the caudal fin is absorbed into the growing tail. Eventually, the fully metamorphosed salamander emerges from the shallows onto dry land to live, normally returning to water only in spring to breed.

At least that's the way it usually works.

SHAPE SHIFTERS This illustration shows the metamorphosis of a tiger salamander from the advanced larval stage (top) to the adult terrestrial phase (bottom). Stressors such as aquatic predators and shrinking natal pools cause a larva to release hormones that trigger the transformation. The amphibian's caudal (tail) fin is absorbed into the growing tail, legs and feet grow larger, external gills disappear, internal lungs grow, and the animal crawls up onto land to live. Occasionally, developing salamanders remain in their larval form and stay in water but still become sexually mature. These are commonly known as axolotls.

In some deep-water lakes and ponds, larvae do not need to race through the larval stage to metamorphose. Because the breeding site never dries up and predators and other stressors aren't present, they can take their time—and they do, often remaining in the aquatic larval form for two or more years.

Occasionally, some barred tiger salamanders actually stay in the larval form while becoming sexually mature and able to reproduce. These atypical permanent larvae are commonly known as axolotls.

Axolotls survive well in certain aquatic habitats, usually deeper waters without competition from egg-devouring crayfish or predation by trout or other fish. They average 6 to 10 inches long and can grow up to a foot—much larger than an adult barred tiger salamander, which rarely reaches 7 inches long.

Because they retain the external gills and caudal fin of the larval stage, even while attaining mature reproductive organs, axolotls are considered by scientists to be "paedomorphs" (from the Greek *paedo* for "child" and *morph*)—sexually mature animals that retain juvenile physical characteristics. Axolotls are also sometimes described as "neotenes"—animals in natal form with sexually mature organs.

Some axolotls eventually continue their development and become terrestrial, while others remain in their larval aquatic form all their lives. It depends on the environment. "Axolotls are found in high-elevation lakes that don't have a lot of good terrestrial habitat," says Maxell. He explains that for some barred tiger salamanders in these challenging environments, it's better to live out their lives in water as larvae rather than take their chances on land.

A barred tiger salamander's axolotl form is similar to but not exactly the same as the more famous true axolotl, a unique salamander species found only in several mountain lakes near Mexico City. This salamander, which almost always stays locked in its larval form, has a large head, lidless eyes, external gills, and limbs with thin digits. In the ancient Aztec language, axolotl is loosely translated as "water dog" or "water monster."

True axolotls of central Mexico differ from the axolotl form of Montana's salamanders in one key respect. The Mexican species is not a temporary phase. Instead, it is hardwired to its permanently larval life and will never metamorphose into an adult terrestrial salamander under natural conditions.

The Mexican axolotl has long commanded the attention of scientific researchers, particularly those investigating evolution and species development.

True axolotls are nearly extinct in their native habitat. Human development has pol-

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Paul Driscoll is a public information specialist at the Montana Department of Environmental Quality.

SEPARATE SPECIES The terrestrial adult barred tiger salamander (above) is found near ponds and wetlands across central and eastern Montana. The true Mexican axolotl (below), though appearing identical to the larval form of the barred tiger salamander, is a separate species and remains in a permanent aquatic larval form. The axolotls in Montana are a life form of the barred tiger salamander and sometimes continue to metamorphose and become terrestrial.

luted their lake and canal habitats, while imported tilapia fish eat the vegetation where they lay their eggs. Yet in laboratory aquariums around the world, true axolotls are thriving. For more than a century, scientists have propagated breeding lines in order to study another amazing aspect of this species: its ability to perfectly regenerate severed limbs, tails, and select body parts. Not surprisingly, a great deal of medical research focuses on this rare attribute.

According to Maxell, barred tiger salamanders remain common throughout much of Montana. James Collins, an expert on the global decline of amphibians and co-author of *Extinction in Our Times*, told me he thinks barred tiger salamanders in the American West may be among the species that end up surviving the viruses and fungi causing the disappearance of many other amphibians. Because these salamanders have "developmental flexibility"—such as the ability to become cannibalistic as larvae or take on the axolotl form—they have been able to survive in many different climate zones and terrain. "Barred tiger salamanders may be among the lucky ones," Collins said.

Still, areas with barred tiger salamanders exhibiting the axolotl life strategy are quite rare. In Montana, they are known to occur only in the Axolotl Basin and a few small lakes near West Yellowstone. Recent surveys conducted by the Montana Natural Heritage Program and Bureau of Land Management found axolotls in only two of the ten lakes and potholes in the Axolotl Basin and none in the one actually named Axolotl Lake. That lake and perhaps others in the basin historically contained axolotls, but trout transplanted there more than a century ago apparently wiped them out.

Whether the Axolotl Basin continues to house its namesake inhabitants into the future will likely depend on the ecological health and stability of a few small lakes in this remote corner of Montana.

CLOCKWISE FROM LEFT: PUBLIC DOMAIN/JOSÉPHE HUËT, 1866; JIM HERRLY; JOHN P. CLARE/CAUDATA.ORG

INCREDIBLE

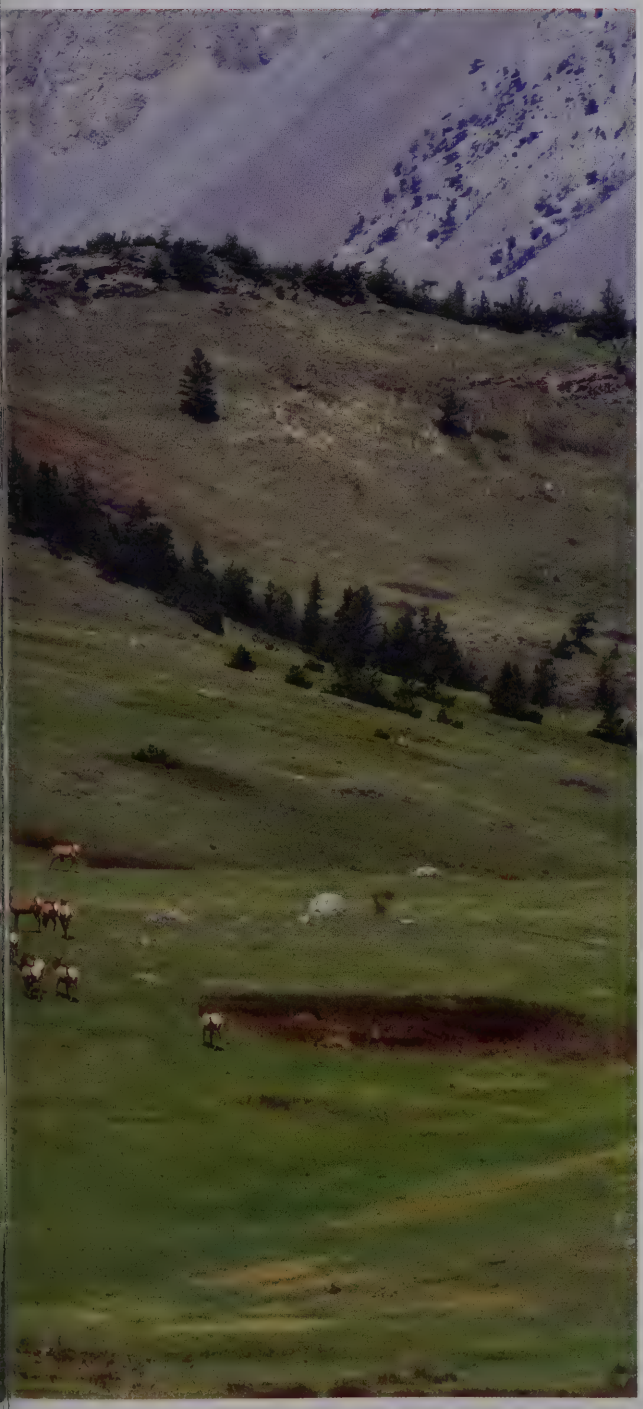
Many big game animals must migrate to survive. For growing numbers,

HEADING HOME Each spring elk migrate from the Sun River WMA uphill into the Bob Marshall Wilderness to feed on newly emerging grasses and forbs. Big game migrations like these have been documented in Montana for more than half a century. In recent years, biologists have been studying ways to maintain historical migration routes and lessen obstacles such as roads and fences (right) that block or disrupt wildlife movement.

JOURNEYS

that's getting harder each year.

BY JIM WILLIAMS AND TOM DICKSON



LEFT: BRENT LONNER; RIGHT: PAUL QUENEAU

EVERYONE KNOWS most bird species migrate. Waterfowl, warblers, and other winged wildlife spend summers in Montana then fly south a thousand miles or more to winter along the Gulf of Mexico or even farther south.

But who knew the seasonal movements of big game species such as bighorn sheep and white-tailed deer are also migrations? Though unable to fly, they—along with elk, mule deer, and pronghorn—must travel to and from distinct habitats just as birds do—and sometimes for remarkable distances.

For instance, Montana Fish, Wildlife & Parks wildlife biologists have tracked mule deer in northeastern Montana moving an average of 64 miles from winter range west of Glasgow to summer fawn-rearing sites in Saskatchewan. Canadian pronghorn head south for 100 miles or more to reach winter range in Montana's Missouri River Breaks. Elk that summer in central Yellowstone National Park travel up to 125 miles north along the Paradise Valley to winter at Dome Mountain Wildlife Management Area.

Even animals not considered long-distance travelers can't stay put all year. In and around Glacier National Park, mountain goats clamber across several miles of rocky cliffs every summer to reach mineral licks. Moose living in the Cabinet Mountains Wilderness travel a dozen miles each December from alpine lake basins downhill to the Fisher River Basin near Libby. Grizzly bears

make seasonal "food migrations" to find high-protein fare such as Army cutworm moths and whitebark pine cone seeds.

"It's a simple fact that most big game animals need to move seasonally to another region to avoid bad weather or find better feeding or breeding conditions," says Joel Berger, a senior conservation scientist with the Wildlife Conservation Society and the John J. Craighead Chair in wildlife biology at the University of Montana (UM).

That movement carries risks such as exposure to predators and increased energy expenditures. Big game animals must sense whether the trip is worth the effort. For many, the answer is yes. Staying put is not an option, explains Kerry Foresman, a UM professor of biology. "A bighorn sheep ewe needs to be in a much different place to rear her lamb in summer than to survive in winter," he says.

Though many wildlife species must travel far and repeatedly each year to survive, that movement has become increasingly difficult. New residential sprawl in western Montana and booming oil and gas fields in the east produce miles and miles of new fences and roads. These obstacles often disrupt "connectivity"—the degree to which the landscape allows animals to move from one place to another. "Big game migration is an ecological process that has operated for thousands if not millions of years," says Berger. "But as parts of the West become more crowded, with increased subdivision and energy development, connectivity is being brokenand migrations are quietly and tragically disappearing."

Jim Williams is the FWP regional wildlife manager in Kalispell. Tom Dickson is the editor of Montana Outdoors.

GETTING FROM HERE TO THERE

Conservationists didn't understand the importance of connectivity until relatively recently. For much of the 20th century, they focused on protecting core habitats—such as wildlife management areas (WMAs), national wildlife refuges, and national parks. Save the best habitat, the thinking went, and wildlife populations will survive.

But since the 1970s, scientists have learned that big game animals also need to move between and among core habitats. "It's not one or the other; you have to have both," says Ken McDonald, head of the FWP Wildlife Division. "We need core areas like our WMAs, and we also need to make sure the land is managed to allow populations to stay connected."

> In other words, with a little planning, western states can have their cake and eat it, too.

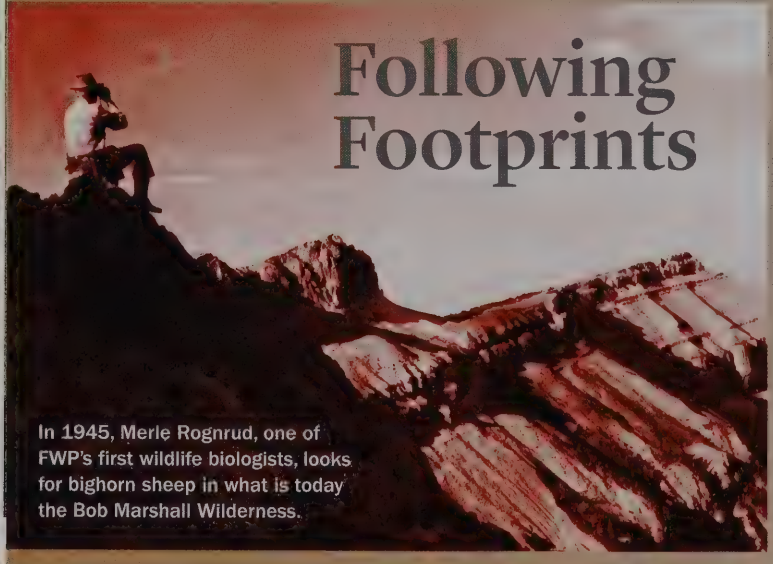
When animals can't move back and forth between core habitats, populations suffer. Migrating pronghorn blocked by woven wire fence can perish in winter cold. Adult grizzly bear females unable to reach high-calorie foods in fall may not produce cubs during hibernation. Mule deer numbers dwindle where habitat is fragmented by new roads crisscrossing oil and gas developments.

Then there's the problem of genetic isolation. Disconnected populations unable to mate with others can lose the genetic diversity and resiliency that helps them ward off disease and survive natural disasters.

MAINTAINING CONNECTIVITY

Conservation groups, state agencies, and others are trying different ways to maintain connectivity and big game mobility. "The main goal is to make the landscape permeable to wildlife movement," says Foresman. One approach is to manage landscapes between protected core habitats so animals can continue traveling back and forth. For instance, FWP helps grizzly bears move across the landscape safely by teaching black bear hunters how to distinguish between the two species and avoid accidental shootings. Other measures include restricting motorized use in the backcountry to protect wildlife raising

Following Footprints



In 1945, Merle Rognrud, one of FWP's first wildlife biologists, looks for bighorn sheep in what is today the Bob Marshall Wilderness.

The timeline at right highlights significant research projects on big game movement by (unless indicated otherwise) FWP wildlife biologists working with Montana State University.

Pioneering biologists such as Bob Cooney, Merle Rognrud, Harold Picton, and Jerry Brown first documented migrations by following animals far into the backcountry on horseback or by foot or snowshoe. Before radiotelemetry, tracking individual big game animals was nearly impossible. Brown sometimes strung rope pendants with visible numbers around the necks of trapped bighorn sheep. After the animals were released, he would then climb steep mountains to see where they went. Sometimes the biologist would carry a ladder on his treks just to gain a few more feet in elevation to better view the wild sheep.

Other FWP biologists who conducted important big game migration studies over the past several decades include, but are not limited to, the names listed in the timeline shown at right and Eugene Allen, Vanna Boccadori, John Cada, John Carnes, Kerry Constan, Jim Cross, Nick DeCesare, Rich DeSimone, John Firebaugh, Arnold Foss, Mike Frisina, Adam Grove, Bob Henderson, Bernie Hildebrand, Richard Knight, Tom Lemke, Allan Lovaas, Gary Olson, Joel Peterson, Kelly Proffitt, Allen Schallenberger, Claire Simmons, Sonja Smith, Bruce Sterling, Shawn Stewart, Dwight Stockstad, Graham Taylor, Joe Weigand, Harold Wentland.

THROUGH THE WOODS The longest documented annual white-tailed deer migration in Montana occurs in the Swan Valley, where deer travel roughly 44 miles from dense conifer winter habitat at Goat and Squeezer Creeks south to summer grounds at Seeley Lake.

young, convincing energy companies to fragment less habitat, and asking ranchers in key migration routes to alter some fences a few times a year.

"Maintaining connectivity doesn't mean moving people off the landscape," says Berger. "But it does require letting people know how they can live in migration routes without impeding wildlife movement."

Montana has anchored many big game migrations by acquiring what were originally called game ranges, now known as WMAs. The Judith River, Sun River, Wall Creek, Mount Silcox, and many other WMAs were bought to protect winter elk habitat while reducing damage to private land by hungry elk.

Also sustaining big game migrations are conservation easements—legal agreements purchased by land trusts and FWP that prevent subdividing on private land and the accompanying fences and roads that go with it. Over the past 35 years, FWP's Habitat Montana Program has used hunter license dollars to protect and enhance several hundred thousand acres of wildlife habitat, mainly with conservation easements.

In the western forested region, the Montana Legacy Project maintained connectivity by allowing FWP, the Montana Department of Natural Resources and Conservation, and the U.S. Forest Service to purchase and secure more than 300,000 acres of private Plum Creek timberlands.

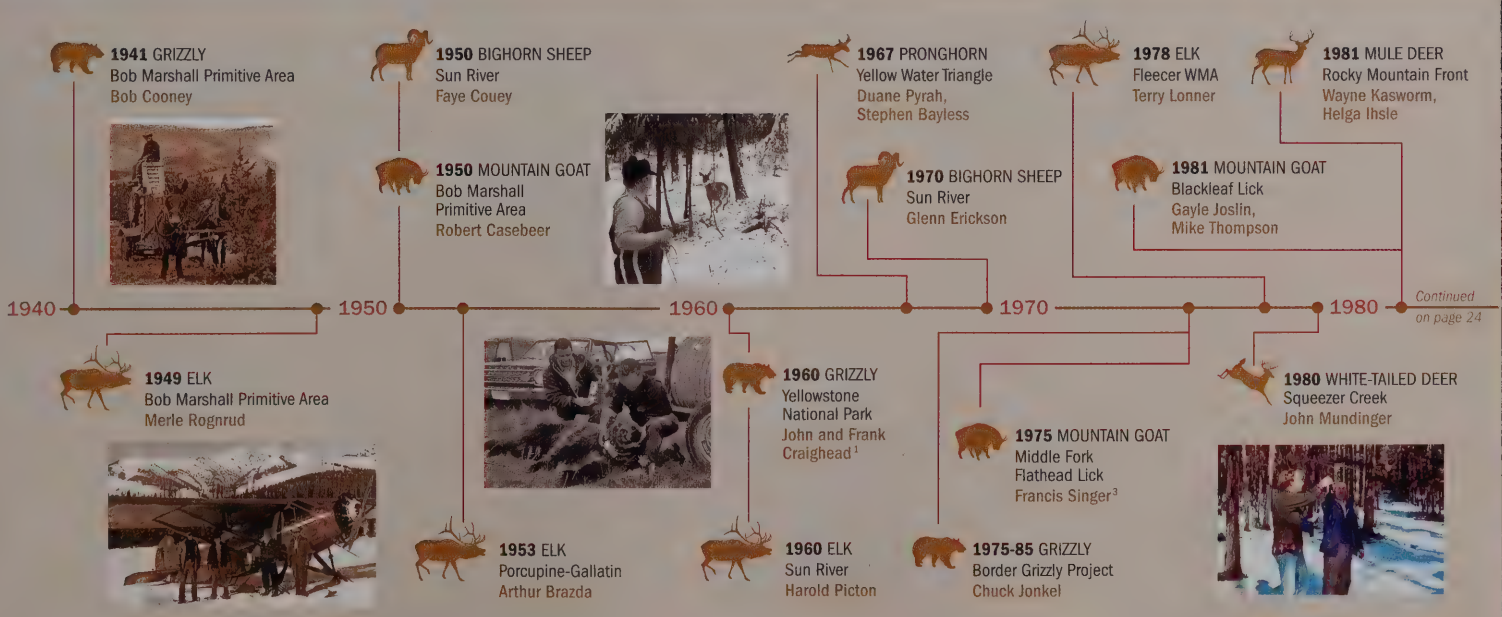
Big game animals also use wildlife corridors that link two or more core areas. Some are natural, such as wooded rivers connecting national forests with WMAs or conservation easements. Others are man-made, like the 42 wildlife passageway culverts recently installed under stretches of U.S. Highway 93 by the Confederated Salish and Kootenai Tribes and Montana Department of Transportation.

Often unrecognized for their essential role in maintaining connectivity are Montana landowners who tolerate large numbers of wildlife on and moving across their property. According to McDonald, private ranch and farm lands in Montana host more seasonal migrations—mainly elk, pronghorn, and mule deer—than public land holdings. "Tolerance in this state is huge," he says.

ON A COLLISION COURSE

Montana and several other western states are now starting to recognize the economic logic of maintaining connectivity through science-based land-use planning. "It's a whole lot cheaper to protect wildlife corridors before doing things like energy development than to try to go in afterward and re-create them," says Sterling Miller, a senior scientist with the National Wildlife Federation in Missoula. In 2007 the Western Governors' Association called for a new approach to energy and residential development. The association created a wildlife council to identify where existing migration routes would be damaged by proposed energy development. "The governors could see they were on a collision course, where the desire to develop energy was conflicting with wildlife, which is hugely important in

ALL PHOTOS FROM FWP ARCHIVES



the West," says Steve Torbit, an expert on landscape conservation for the U.S. Fish & Wildlife Service's Prairie-Mountain Region. "They realized that by mapping core areas and wildlife routes, development could still occur while keeping the landscape permeable to wildlife movement."

In other words, with a little planning, western states can have their cake and eat it, too.

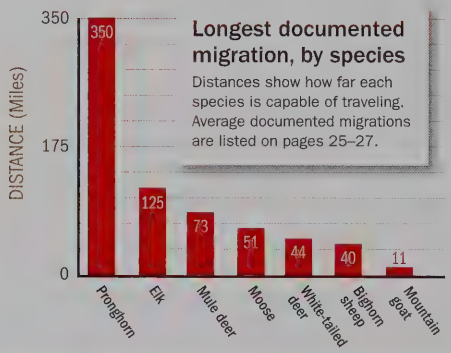
For that to happen, biologists, planners, and decisionmakers must know which routes wildlife use and what obstructs or disrupts that movement. This is where research comes in. "We need to understand the animals' responses to natural areas and human development," says Justin Gude, who manages FWP's wildlife research activities. "Does this corridor work? Is this landscape connected? The answer completely depends on the species."

FWP biologists have been tracking wildlife migrations since the 1950s, when they followed elk and sheep by horseback. Using telemetry in the 1960s, biologists began documenting more migration routes. Now with GPS satellite technology, research scientists are finding that Montana big game animals move farther than ever imagined.

In one recent study, biologists learned that a single pronghorn traveled more than 350 miles as it fled brutal winter conditions in search of food and shelter south of Glasgow. An aerial photo from that same study showed a mile-long herd of 400 pronghorn migrating south across east-central Montana in temperatures of nearly -40 F. The picture shows the antelope, blocked by a barbed-wire fence, lying down in the brutal cold to conserve energy. Biologists later learned the animals eventually found a gap in the wire and continued their journey.

But that was just one fence.

"We've secured many core habitats," says McDonald. "Now we need to know where the animals are going, what obstacles are in their way, and what can be done to reduce barriers and conserve those historical routes."

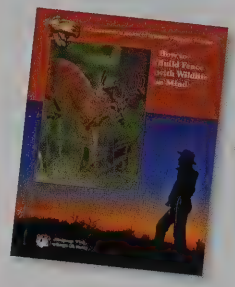


MAPS AND GUIDES FOR PLANNING, FENCING

♦ The FWP website provides **recommendations on subdivision development** to help communities accommodate new housing while retaining healthy wildlife habitat and migration routes. Visit fwp.mt.gov and search for "subdivision."

♦ FWP has mapped all crucial wildlife habitats in Montana and makes that information available to planners, developers, and others through its web-based **Crucial Areas Planning System (CAPS)**. Visit fwp.mt.gov and search for "Crucial Areas."

♦ The department has recently revised its **guide to building and altering fences** to allow migrating wildlife to move more freely. The booklet contains diagrams, instructions, and advice on creating fences that reduce entanglements and barriers. Get a free copy by calling Joe Weigand, FWP private land wildlife specialist, at (406) 444-3065.



The data in this article comes from 173 Montana radiotelemetry studies and other reports dating to the 1950s that Jim Williams recently compiled. His goal was to document a sample of average distances covered by different species to and from winter and summer ranges and, in some cases, the routes they took.

This large database represents just a portion of what biologists must learn to conserve big game migration routes. Future aerial surveys and studies will help conservationists and policymakers accommodate sensible residential and energy development across Montana while ensuring that landscapes remain permeable to critical wildlife movement.

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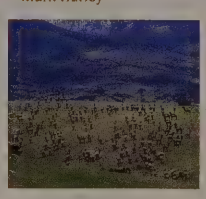


1980 — 1990 — 2000 — 2010

1981 BIGHORN SHEEP
Beartooth Rock Creek
Steve Martin

1989 MULE DEER
Missouri Breaks
Ken Hamlin,
Richard Mackie

1990 ELK
Dome Mountain WMA
John Vore

1985 MOOSE
Yaak River
Randy Matchett

1991 MULE DEER
Bridger Mountains
Dave Pac,
Richard Mackie

1989 GRIZZLY
Teton River
Keith Aune,
Wayne Kasworm

1994 ELK
Blackfoot-Clearwater WMA
Mark Hurley[2]

1997 GRIZZLY
South Fork Study
Rick Mace

2002 ELK
West Yellowstone
Ken Hamlin,
Mike Ross

2006 WHITE-TAILED DEER
Ray Kuhns WMA
Gary Dusek, John Morgan,
Carolyn Sime, Alan Wood

2008 BIGHORN SHEEP
Mount Silcox WMA
Kerry Foresman[4]

2009 MULE DEER
Bitter Creek
Pat Gunderson

2009 ELK
Dome Mountain WMA
Ken Hamlin,
Julie Cunningham,
Bob Garrott

2012 GRIZZLY
Swan Valley
Rick Mace
Tonya Chilton

2011 GRIZZLY
Rocky Mtn. Front
Mike Madel

2012 PRONGHORN
Bitter Creek
Andrew Jakes[5]

2013 ELK
Flathead Indian
Reservation
Dale Becker[6],
Stacy Courville[6]

1. Independent research
2. UM master's degree thesis
3. Glacier National Park report
4. University of Montana research
5. University of Calgary Ph.D. thesis
6. Confederated Salish Kootenai Tribes

EXAMPLES OF BIG GAME MIGRATIONS

White-tailed deer

Average/longest documented migration distance: 12/44 miles

Major migration concerns: Roads and fences from new subdivisions; removal of conifers on winter range

In much of the United States, whitetails don't need to move far. They usually find all the food and shelter they require within a few square miles of woodlots, suburbs, and corn fields. But in the mountainous West, white-tailed deer must often travel many miles to find livable conditions, especially in winter. Based on 40 years of radio-tracking data, FWP biologists know that whitetails migrate to dense forests during cold months. While staying protected in the forest, the animals move down in elevation as far as possible in search of habitat containing conifer needles to eat, overhead tree canopy to intercept snow (so they can move around more easily), and thermal protection created by dense stands of second-growth Douglas fir and other evergreens.

The longest documented whitetail migration in Montana is of deer moving in late fall from the Seeley Lake area through the Seeley-Swan Valley to Goat and Squeezer Creeks, roughly 44 miles each way. The Montana Legacy Project, which converted private Plum Creek timberlands into public holdings, protects most of the Seeley-Swan landscape and the migrations it supports.

Moose

Average/longest documented migration distance: 12/51 miles

Major migration concerns: Vehicle collisions in valley winter range; climate change that reduces and isolates cool, wet habitats; predators in some areas

Moose are one of the state's least-studied big game animals. Biologists know little of their seasonal movements or migrations except that moose summer in high-elevation forests and then, in fall, move to staging areas at mid-elevation in or near clear-cuts or burned areas. In winter, moose continue downhill to low-elevation forests. One study found that moose in the Cabinet Mountains Wilderness near Libby migrated each winter roughly 15 miles from summer habitat in alpine cirques downhill to the Fisher River Basin. FWP recently began a study of moose ecology, including migration, in the Big Hole Valley, in the Cabinet Mountains, and along the Rocky Mountain Front to learn more about the species' movements and habitat requirements.

Bighorn sheep

Average/longest documented migration distance: 8/40 miles

Major migration concerns: Vehicle collisions when in valley winter range; disease

Bighorn sheep migrate along historical routes from summer habitat in high mountain areas to winter grazing grounds in the foothills. In spring they reverse course and follow new vegetation growth from

LEFT TO RIGHT: DONALDMJONES.COM; FWP

low-elevation winter range to alpine summer range. Some wild sheep, such as those in the Bob Marshall Wilderness, migrate just a few miles, while others travel 40 miles each way. One FWP study followed radio-collared bighorns moving from winter range at the Beartooth Face near Red Lodge across the Beartooth Plateau to summer range at Wolverine Peak near Cooke City. Biologists found that these family groups, composed mainly of ewes with their young lambs, traveled an average of 8 miles per day for four or five days before reaching new seasonal habitat. Near Thompson Falls, scientists have tracked bighorn migrating from the high reaches of Marmot Peak south down Sundance Ridge then along cliff faces to winter range in the Mount Silcox WMA.

Because bighorn sheep don't deviate from established seasonal ranges and migration courses, biologists speculate that most of the animals follow routes thousands of years old, established since the last ice age.

Elk

Average/longest documented migration distance: 15/125 miles

Major migration concerns: Loss of winter range from residental development; predators in some areas

Elk are the most well-known big game migrators in Montana. Hunters, ranchers, and others have long known that elk spend summers high in the mountains. When cold and snow arrive, they move to lower-elevation foothills in search of exposed, windblown bunchgrass. Unfortunately for some ranchers, these areas are also prime cattle rangelands. Responding to elk migrations in winter, FWP purchased in the mid-1900s the state's first game ranges along the Judith River and the Sun River. The idea was to manage winter habitat to support more elk while luring many of the animals away from adjacent ranchlands, where they competed with cattle for grass and knocked down fences.

Elk migrations range from just 15 miles, such as between the Sun River WMA and the Bob Marshall Wilderness, to 125 miles, like the one from winter range in Dome Mountain WMA in the Paradise Valley to summer range high in Yellowstone National Park.

Because most early game range acquisitions were for elk winter habitat, more migration routes have been conserved for this species than any other in Montana.

Mountain goat

Average/longest documented migration distance: 5/11 miles

Major migration concerns: Climate change that reduces and isolates cold and snowy alpine habitats

Some mountain goats migrate several miles or more from summer range downhill to distinct winter range. Those that don't migrate still move around from season to season within their home range.

Many mountain goats also make a "lick migration." Because their winter foods lack essential minerals such as salt, the animals migrate up to 10 miles in late spring to reach exposed cliff faces where they can lick potassium, calcium, and especially sodium from rocks. For instance, goats that spend much of the year at Our Lake, an alpine basin along the Rocky Mountain Front northwest of Choteau, will travel 5 miles over steep terrain to reach licks at Billie and Deep Creeks. Mountain goats remain at mineral (salt) licks for a few weeks up to more than a month before returning to their primary habitat.

BIGHORN PHOTO: PAUL QUENEAU; ELK: W. STEVE SHERMAN; MOUNTAIN GOAT: LARRY STOLTE

Grizzly bear

Longest documented fall chokecherry "migration": 175 miles

Major connectivity concerns: Roads that increase illegal kills and vehicle collisions; residential development that increases garbage problems that require bear removal; climate change that could lessen wild berry and whitebark pine production

Grizzly bears don't migrate in herds like pronghorn or elk, but they do move as individuals or small family units throughout the year in search of fattening foods. One documented "food migration" is from the Rocky Mountain Front east along creek drainages flowing into the Teton and Sun Rivers, where the bears find dense stands of chokecherries. West of the Continental Divide, grizzlies move up and down elevation searching for large concentrations of huckleberries or whitebark pine cones.

In summer 2006, one collared bear traveled twice from Lindbergh Lake in the Mission Mountains north along the Swan River to just outside Kalispell in the lower Flathead Valley, searching for ripe chokecherries. The first time he arrived, the fruit wasn't ripe, so he returned to Lindbergh Lake and waited a few more weeks before heading back to find edible berries.

Some grizzly bears also make "moth migrations." In late spring, Army cutworm moths fly from prairie states to high elevations throughout the Rocky Mountains to feed on alpine flower nectar. In August, grizzlies move to higher elevations to feast on the vast moth congregations.

Pronghorn

Average/longest documented migration distance: 46/350 miles

Major migration concerns: Fencing and roads from increased energy development

Most antelope don't need to travel far, meeting their seasonal needs by moving only within their home range. But some make great migrations. Biologists have tracked herds traveling more than 100 miles south from southern Alberta and Saskatchewan into Montana

in winter. Some Canadian herds, perhaps following ancient routes thousands of years old, hit Fort Peck Reservoir and cross its frozen surface, only to be stranded on the lake's south shore in spring.

Mule deer

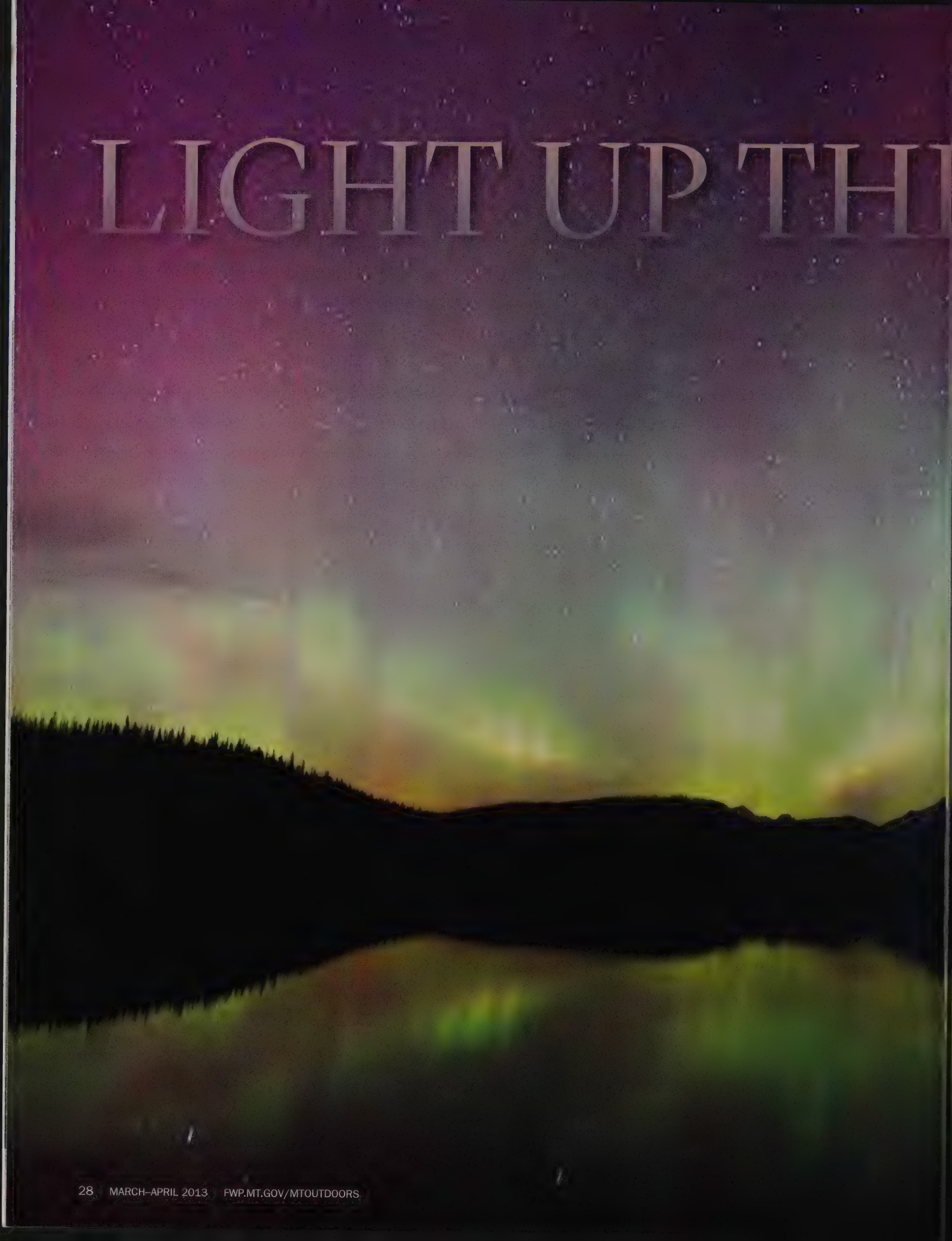
Average/longest documented migration distance: 12/73 miles

Major migration concerns: In prairies, roads and fences from new energy development; in some mountains, residential development that alters routes and eats up winter range

Many eastern Montana muleys don't migrate but instead move within their home range to find preferred seasonal habitats. But in severe winters, some mule deer must leave the open shortgrass prairie to escape the drifting snow that can strand them in brutally cold temperatures. These muleys travel for miles in search of broken topography such as deep ravines along river breaks. There they find refuge from driving winds and browse edible shrubs exposed on windblown ridges.

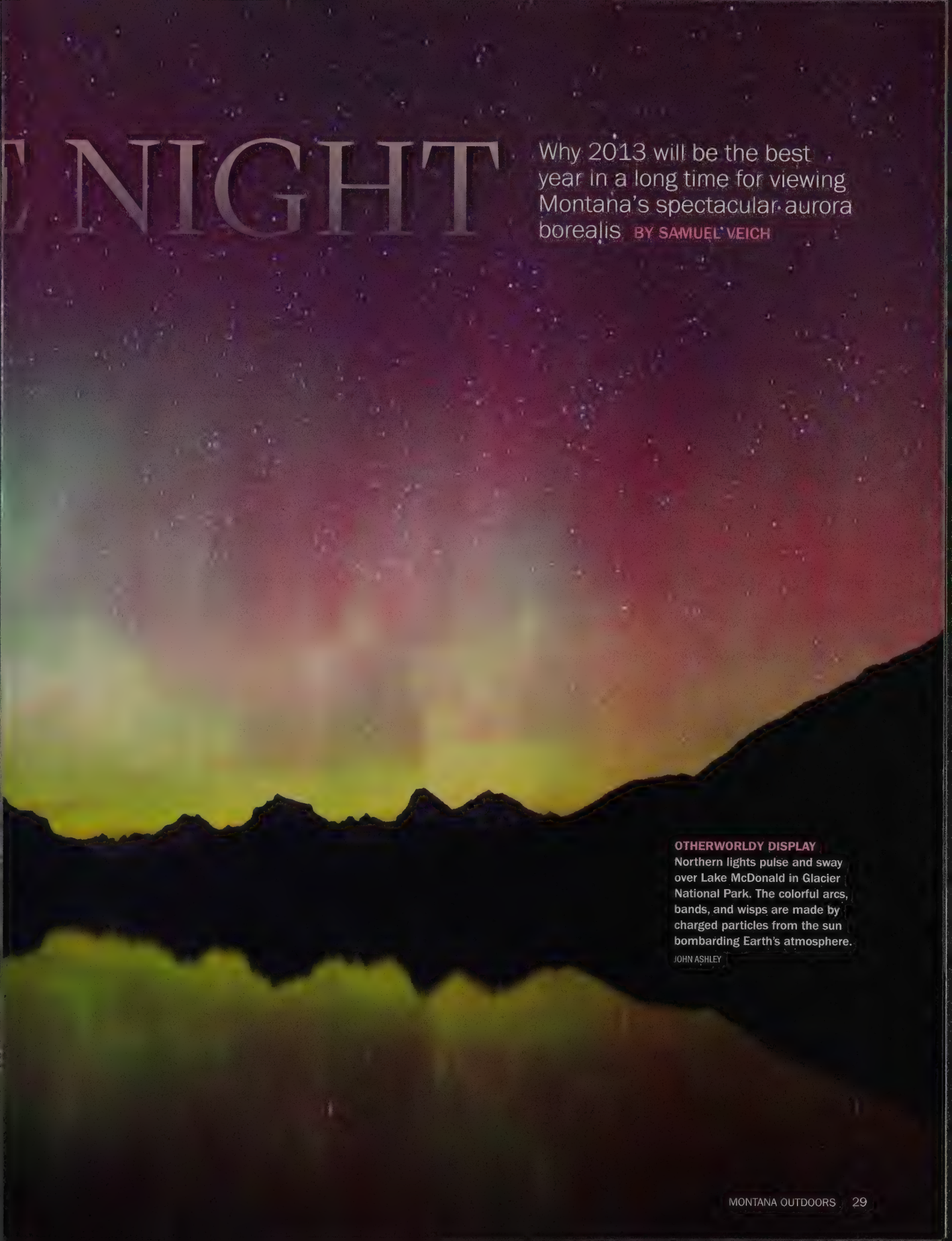
Many mountain muleys migrate. Biologists tracked an annual spring migration from the Judith River WMA near Lewistown southwest across the Castle and Little Belt Mountains to summer grounds in the Gallatin Valley. They also documented three generations of mule deer does that migrate from Yellowstone National Park north through the Paradise Valley and over I-90 to winter in lower elevations of the Bridger Mountains. In late fall, some mule deer that summer in the Spotted Bear drainage south of Hungry Horse Reservoir move east across the Bob Marshall Wilderness to Ear Mountain WMA on the Rocky Mountain Front. ■

GRIZZLY PHOTO: JOE MCDONALD; PRONGHORN: ERIK PETERSEN; MULE DEER: PAUL QUENEAU


LIGHT UP THI

NIGHT

Why 2013 will be the best year in a long time for viewing Montana's spectacular aurora borealis BY SAMUEL VEICH



OTHERWORLDY DISPLAY Northern lights pulse and sway over Lake McDonald in Glacier National Park. The colorful arcs, bands, and wisps are made by charged particles from the sun bombarding Earth's atmosphere.
JOHN ASHLEY

In the middle of a winter night when I was nine years old, my mother woke me and my sister and hurried us outside. She pointed to the Whitefish Range north of our home in the Flathead Valley. We watched in wonder as curtains of pale green and white light danced in the night sky over the mountain peaks. Ever since that spellbinding sight nearly four decades ago, I have been enthralled by the northern lights.

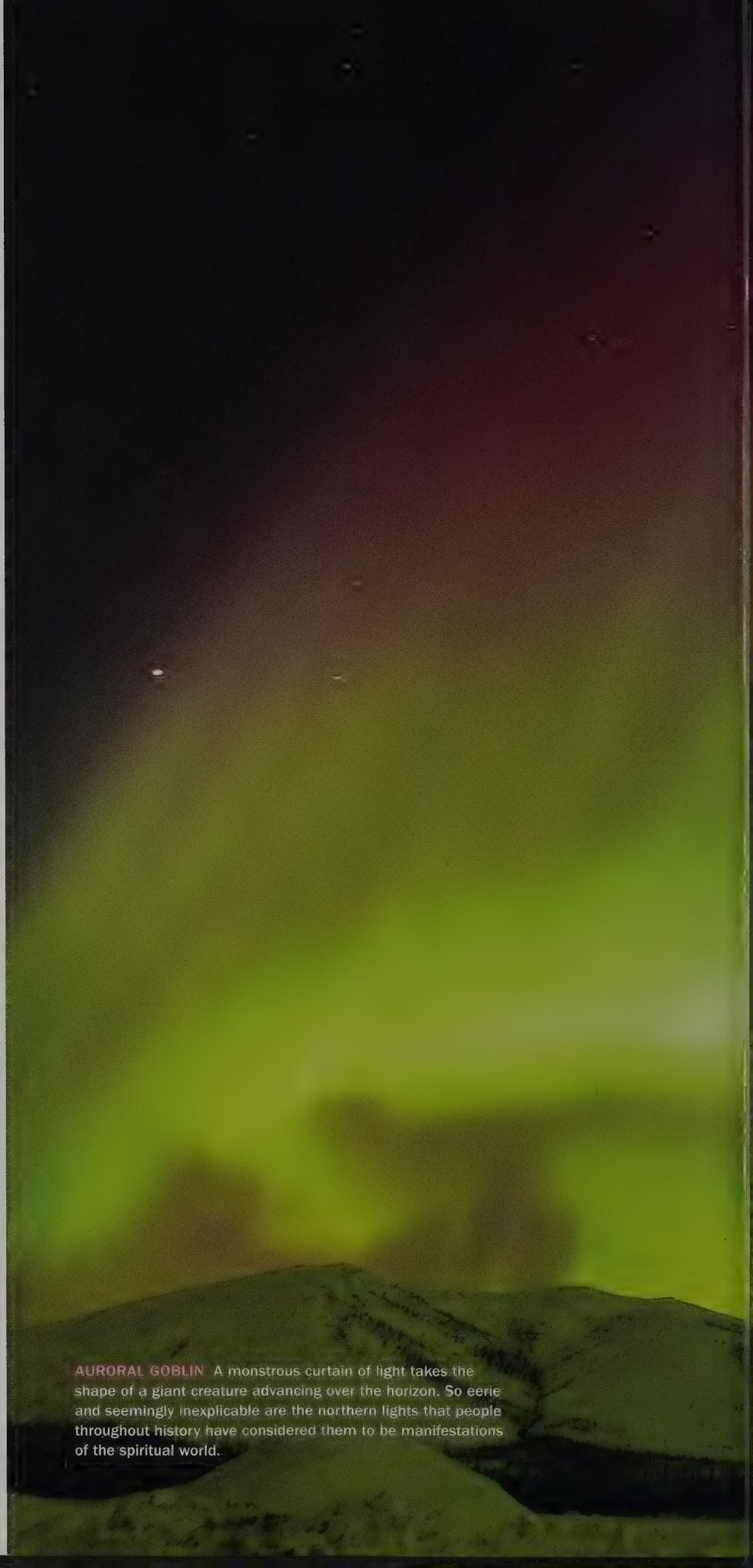
These next two years will be ideal for aurora fans, as well as those seeing the northern lights for the first time. Scientists predict these glowing, horizon-wide arcs, bands, and wisps will occur more regularly and frequently in 2013 and 2014 than at any time in the past decade.

"FIRE" IN THE SKY

Throughout the world, people have long been fascinated by the northern lights—known in the Northern Hemisphere as aurora borealis (named for the Roman goddess of the dawn, Aurora, and the Greek north wind god, Boreas) and aurora australis or southern lights in the Southern Hemisphere.

The night sky phenomenon inspired many North American aboriginal legends. In one, the Algonquin god Nanabozho, who created the universe, traveled north after completing Earth and built large fires that occasionally illuminated the sky and sent a sign of celestial goodwill. In some Eskimo cultures, the lights are spirits of their dead playing ball with a walrus skull; in others, auroras are spirits of dead walruses playing with a human skull. Some Inuit tribes believe the lights are the dancing souls of ancestors, while the Point Barrow Inuit people

Samuel Veich is a professional photographer and amateur astronomer in Kalispell.



AURORAL GOBLIN A monstrous curtain of light takes the shape of a giant creature advancing over the horizon. So eerie and seemingly inexplicable are the northern lights that people throughout history have considered them to be manifestations of the spiritual world.

ANDY LONG

carry knives to protect themselves from auroras, which they believe are evil spirits.

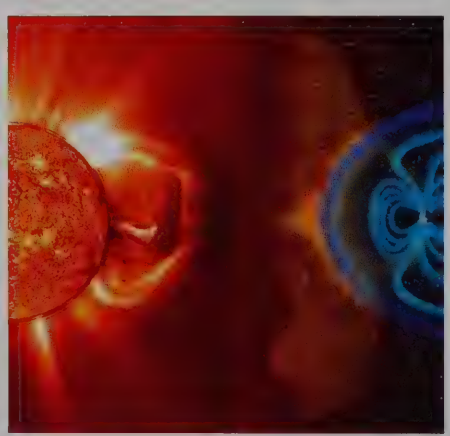
Elsewhere in the world, auroras have been perceived as a monstrous fox, the fiery breath of dragons, or a sign of weather to come. Norse mythology from the 13th century considered auroras to be guiding lights leading to the heavenly hall of Valhalla. In AD 37, the Roman emperor Tiberius, believing the port city of Ostia was burning, sent his army north to help the citizens. What he actually saw was a rare brilliant red aurora.

In modern times, many UFO "sightings" are actually the northern lights. That's not surprising. Many people still don't know why the night sky occasionally pulses with otherworldly green, purple, and white light.

PARTICLES HITTING PARTICLES

Auroras are indeed created by visitors from space—not aliens, however, but electrically charged particles released from the sun's atmosphere that collide with gaseous particles in Earth's atmosphere.

The sun constantly throws off electrons and protons produced by its intensely hot surface. Earth's magnetosphere—atmospheric shields created by the planet's magnetic fields—usually protects us from these streams of charged particles known as solar winds. But when the sun produces large coronal mass eruptions (CMEs), solar wind speeds can increase to nearly 1 million



COLORFUL CLASH Northern lights occur when collisions between electrically charged particles from the sun (left) enter Earth's atmosphere (right). "Excited" electrons concentrated above the magnetic poles of the Northern and Southern Hemispheres then emit visible light.

BROAD PALETTE The diverse colors of auroras come from the different atmospheric gases being disrupted. Nitrogen atoms produce blues and deep purples, while oxygen creates greens

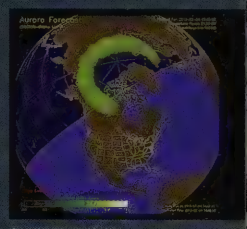
and light reds. Various combinations of the two gases can make the sky turn violet or yellow. A rare pale blue hue sometimes occurs just before dawn or right after sunset.

CLOCKWISE FROM TOP LEFT: NORMAN JACOBSON; SAMUEL VEICH; SWPC.NOAA.GOV; SAMUEL VEICH; STEVE MITCHELL; NASA.GOV

SEE THE LIGHTS

Even though 2013 and 2014 will be great years for seeing auroras, the lights don't appear every night—and sometimes not for weeks or even months. That's why you need to know about the K-index.

The K-index (Kp) is a measurement of the relative fluctuation in Earth's geomagnetic fields. The higher the K-index (on a scale of 0 to 9), the better your chances of viewing the northern lights and seeing them at lower latitudes.



Auroral activity

For regions of Montana south of I-90, a Kp of 7 or higher is generally required to see the northern lights. As you approach the Canadian border, auroras are visible at Kp 6 or even Kp 5. In other words, there has to be much more geomagnetic activity in the atmosphere for someone in Billings to see the northern lights than for someone in Columbia Falls.

Locate the current K-index in the left column of the informative website spaceweather.com. There you will also find the National Oceanic and Atmospheric Administration's (NOAA's) forecast for geomagnetic storms. The greater the probability of a solar storm, the greater the odds of spectacular aurora displays. (It usually takes two or three days for a large storm to show up as auroras here on Earth.)

If you don't want to check for solar activity each day, you can buy a cell phone app (http://spaceweathertext.com/) that tells you when the Kp for your area reaches a certain level (which you specify).

Another helpful site is NOAA's Space Weather Now Page (swpc.noaa.gov/SWN/index.html), which shows geomagnetic storm activity. The storms are rated on a scale of increasing intensity from G1 to G5. Look for storms of G2 or greater for the best northern lights viewing potential in Montana.

Both websites also include a map displaying the current "auroral oval," the estimated area of northern lights distribution.

OTHER VIEWING TIPS:

- Seek areas away from urban light pollution. If the aurora is strong enough, you can see it from towns and suburbs, but the display will be much brighter if you move at least a dozen or so miles away from city lights.
- Auroras can show up any time of year, but the longer nights of late fall, winter, and early spring offer more viewing opportunities. Though you can see auroras any time of the night, peak times are from an hour before midnight to an hour after.
- Cloudless nights are best.
- You may need to wait 15 minutes or more before your eyes adapt to the dark, allowing you to see faint auroras.
- The days of a new moon and three or four days before and after (waning and waxing) allow for better viewing. Auroras may be seen during a full moon, but the lights are washed out by the lunar brightness.

miles per hour. During these solar storms, which increase then decrease in frequency over 11-year cycles, the sun's high-energy particles smash into Earth's magnetosphere, which funnels them toward the two magnetic poles. The disruption, 50 to 400 miles above Earth's surface, causes electrons of nitrogen and oxygen to become "excited," or transition to a higher energy state. Similar to what happens in a neon sign, the electrons then "de-excite" and return to their original condition, emitting a tiny visible light.

That chemical process, multiplied trillions and trillions of times, produces the northern lights.

The colors of auroras depend on which atmospheric gas is being disrupted. Excited oxygen atoms create green and light red hues, while nitrogen atoms produce blues and deep purples. Tinges of violet and yellow occasionally appear, depending on the proportions of oxygen and nitrogen. The waving curtain-like displays I first saw as a boy are produced by light hitting undulating magnetic field lines.

Auroras may occur at any time. But the greatest number takes place within a year or two of the "solar maximum"—the year during the solar cycle in which the occurrence of sun spots (giant magnetic islands on the sun that produce CMEs)—is at its greatest frequency.

Because scientists predict 2013 to be the solar maximum of this current cycle, this year and 2014 will provide many excellent opportunities to see the beautiful dance of the night sky in Montana.

STEADY SHOT A photographer adjusts his camera and tripod before using a shutter release cord to prevent camera shake that blurs photos. Note in this photo how including a person and background scenery enhances the northern lights' effect.

SHOOT THE LIGHTS

When photographing auroras, you'll need a tripod to keep the image from blurring during the long exposure time required. A cable or electronic shutter release is also valuable.

For sharper aurora images, set your digital camera to a faster ISO (1000 or greater). This will give you less "smearing" in your images, though it also results in less color saturation and increased graininess. While producing images with less sharpness, a lower ISO setting (100 or 200) greatly improves color saturation because the longer exposure allows the camera to pick up more auroral colors and hues than what you see with your eyes.

Exposure times vary with auroral intensity. For best results, experiment with exposures starting at around 20 to 30 seconds.

OTHER PHOTOGRAPHY TIPS:

- The best photos come from digital SLR cameras that adjust for the "noise" (pixilation) that comes from the long exposure times required for night sky photography.
- Wide-angle lenses work best.
- Try to include trees, hills, or skyline in your photograph (see examples in this article). Background scenery helps provide visual context for the northern lights' massive scale, and it connects the colorful display to the dark landscape below.

LEFT: ROBERT BERDAN; OPPOSITE PAGE: ANDY LONG

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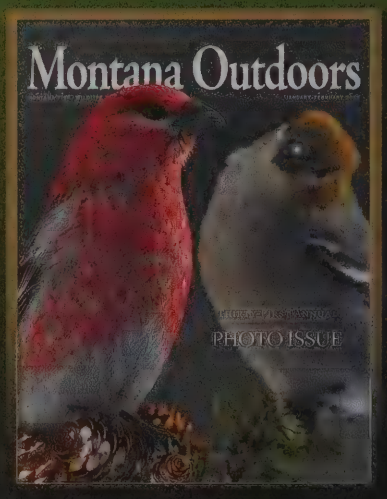

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WAVING GOODBYE Undulating curtain-like movements are produced by light hitting magnetic field lines. Your best chance to see these and other auroral effects will be early this spring and all of next winter.

The Elk Are There

By Bruce Auchly

Didn't get your elk? I can sympathize, having been blanked myself many times over the years.

Not getting an elk can be chalked up to bad luck, tough hunting conditions, lack of effort, or difficulty obtaining access to private land. But—with exceptions in some areas where wolves and other predators are taking a bite out of populations—it's not because of too few elk.

Montana has no overall elk shortage. Biologists estimate that as many as 150,000 roamed across the state last fall before hunting season. And the population has remained relatively steady for most of the past 20 years.

That's only a fraction of the elk's presettlement population, but it's an incredible rebound from 100 or so years ago.

One estimate places only 50,000 elk remaining in all of North America at the turn of the 20th century. Compare that with a guess of 10 million elk roaming the continent before European settlement.

In Montana at the time of Lewis and Clark, there were almost certainly more elk than today. Vast open prairies of grass, cottonwood bottoms, and badlands made eastern and central parts of pre-Montana a paradise for game animals.

By comparison, the heavily timbered western region was poor elk habitat. The animals were present but not in numbers found on the prairie.

Then came the settlers, and Montana's game animal populations started to decline. By the early 1900s only small herds of elk remained—around Yellowstone National Park, along the Continental Divide, and in a few other remote mountainous areas where they could escape hunters.

In 1910 fewer than 5,000 elk were scattered over 25,000 square miles in the state's northwestern region. And elk had all but disappeared from eastern Montana.

That's when Montanans began transplanting elk from near and within Yellowstone National Park. The first effort moved elk from Gardiner to the Butte area. It proved so successful and popular that sportsmen and landowners in other parts of the state wanted to reestablish herds.

Within ten years, elk were transplanted to the Highwood Mountains east of Great Falls, then to the Little Belt Mountains in 1928, to the Big Belt and Judith Mountains in 1935, and to the Missouri Breaks in 1951.

Most elk trapping and transplanting stopped in 1972. It wasn't needed anymore. Elk were doing fine on their own.

In most cases these days, elk numbers in various parts of the state are largely based on social factors—a balance of what hunters want and ranchers and farmers will tolerate. Agricultural interests often push for fewer elk, which compete with their cattle for pasture and crops; sportsmen ask for more.

Montana's landscape could support many more elk than the current population. Hunters who didn't get an elk this year likely believe more is better. Many landowners who would have to host those extra animals on their property say: No thanks, fewer is just fine.

Both sides have usually been willing to give a little, resulting in the overall elk population we have today.

That cooperation among Montanans has taken us from a closed hunting season in 1893 for lack of elk to today's healthy elk population. That incredible restoration came about thanks to landowners and hunters working together.

These are the good old days of elk hunting, whether you got your elk or not.

Bruce Auchly manages the FWP regional Information and Education Program in Great Falls.

Smooth green snake

Liochlorophis vernalis

By Dennis C. Joyes

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"He's cute," announced my six-year-old niece. When it comes to animals, Annika is the judge of all things adorable. In this case, however, the object of interest was not a kitten or a newborn calf. Instead, I had just caught a smooth green snake, a seldom-seen species that inhabits mixed-grass prairies and wetlands in northeastern Montana. They are "cute" by virtue of being one of the smallest snakes in the state and the only one green in color. Although extremely shy, smooth green snakes are docile when handled, are not venomous, and do not bite. What's more, their insect-based diet makes them a friend of farmers and gardeners.

IDENTIFICATION

Smooth green snakes are pure green, with a milky white to cream underside and no markings. The tongue is red with a black tip. In Montana the species runs from 12 to 28 inches long. Most of the ones I've seen are around a foot long and as slender as a pencil. Their color and size make the snakes all but invisible in green vegetation. But on bare ground they are easily spotted and a rather surprising sight. The snakes are "smooth" in two respects: They have no pattern and, lacking keeled scales, have a silky feel—a feature that sets them apart from the rough green snake of the southeastern United States.

Dennis C. Joyes is a writer in Toronto, Ontario.

HABITS

Smooth green snakes are active from April through September, and then only when the temperature is above 70 degrees. Adults feed almost exclusively on spiders and insects, including grasshoppers, crickets, beetles, ants, and caterpillars. Hawks and garter snakes are among their known predators. Smooth green snakes hibernate in animal burrows or ant mounds, both abundant in the state's northeastern corner.

REPRODUCTION

Nesting takes place from late July through August in rodent burrows, under rocks, or in piles of decaying vegetation. Several females may share a nest. They each lay, on average, six whitish, 1-inch-long eggs. The young emerge in late August or early September after an incubation of about two weeks.

DISTRIBUTION AND HABITAT

Smooth green snakes have a wide but patchy distribution in North America—what biologists call "disjunct populations." Isolated populations are scattered across the Great Plains and West from Iowa and Nebraska to low-elevation areas of Utah, Colorado, and New Mexico.

The usual explanation for a species showing up in unconnected regions is that it was once more widely distributed but, as the environment changed (perhaps as long ago as the end of the last ice age), isolated populations were left behind in pockets of favorable habitat.

The smooth green snake's primary range extends from the Great Lakes eastward to Maine and the other New England states. The Montana population, although not isolated, exists at the tail end of a narrow corridor extending west from Minnesota along the Canada-U.S. border. In Montana, the smooth green snake has been observed only in three northeastern counties: Sheridan, Daniels, and Roosevelt. Even there, the species was not officially reported until 1968, and no specimens were collected until 1998.

Scientific name

Liochlorophis is likely a formation of the Latin *lio* for "lion" and *chloro* for "green." *Vernalis* comes from the Latin *vernal*, which means "from spring."

Smooth green snakes appear to be thriving in Medicine Lake National Wildlife Refuge and in the pothole prairies of eastern and northern Sheridan County. Most sightings actually occur in rural backyards and gardens, where the snakes are drawn to the moist irrigated habitat and rich insect life.

CONSERVATION STATUS

Because of its very limited distribution and narrow habitat requirements, the smooth green snake is listed as a species of concern in Montana. The main threats come from pesticides that eliminate the insects they eat, climate change that creates drier conditions, and road mortality from increased traffic caused by the Bakken oil boom. FWP, The Nature Conservancy, Ducks Unlimited, and other organizations are working to preserve wetlands and native prairies of northeastern Montana. One of the many species to benefit from that conservation work will be this cute little reptile.

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PARTING SHOT

BLUE EYED NELLIE
WILDLIFE MANAGEMENT AREA
IN 1967 75 BIGHORN SHEEP WERE TRANSPLANTED TO OLSON GULCH.
THE HERD WINTERING ON THIS PROPERTY ARE THE DECENDENTS OF THAT TRANSPLANT.
THE U.S. FOREST SERVICE ACQUIRED 14,500 ACRES OF BIGHORN HABITAT IN THE LOST CREEK LAND EXCHANGE IN 1993
THIS SMALL BUT CRITICAL WMA WAS ACQUIRED IN 1989 BY MONTANA FISH AND WILDLIFE AND PARKS WITH SHEEP AUCTION FUNDS.

WINTER ESCAPE Blue Eyed Nellie Wildlife Management Area near Anaconda provides winter range for bighorn sheep that migrate down from summer habitat in the Flint Creek Range. Migrations by elk, mule deer, and other big game species also are anchored by many WMAs. Learn why wildlife need to move to these and other critical habitats starting on page 20. Photo by Phil Farnes.

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